The Builder.

VOL. XXVII.—No. 1386.

On the Pollution of Rivers.

IN the year 1865 a Royal Commission was appointed to inquire how far the present use of rivers and running waters in England for the purpose of carrying off the sewage of towns and populous places, and the refuse arising from industrial processes and manufactures, can be prevented without risk to the public health or serious injury to such processes and manufactures, and how far such sewage and refuse can be utilised or got rid of otherwise than by discharge into rivers or running waters, or rendered harmless before reaching them; and to inquire into the effect on the drainage of lands and inhabited places, of obstructions to the natural flow of rivers and streams caused by mills, weirs, locks, and other navigation works; and into the best means of remedying any evils thence arising; and the then Secretary of State for the Home Department directed the Commission to select several river basins illustrating different classes of employment and population, suggesting that these localities might be:—

1. The Thames valley.
2. The Mersey valley.
3. The Aire and Calder basin.
4. The Severn basin.
5. The Taff valley.
6. A river basin comprising a mining district in Cornwall.

In pursuance of their instructions the Commissioners took up the question in the order of, first, the river Thames; secondly, the river Lea; and thirdly, the Aire and Calder rivers, and made their report in March, 1866.

The River Thames.

The Thames basin extends from Shoeburyness to a point five miles west of Cirencester, and from Fernhurst, in Sussex, to Priors Marston, in Warwickshire, and embraces an area of 5,162 square miles, or 3,303,680 acres. The main stream of the Thames, which drains the water from this area into the sea, is 201 miles in length from the estuary to the source in the Cotteswold hills, and the height of the Thames-head spring, in Trewsbury Mead, is 340 ft. above the mean level of the sea.

The Thames receives 22 tributaries in its course to the sea.

As the main river supplies most of the water that is consumed in London for domestic and other purposes, the Commissioners considered it important to distinguish the tributaries that come into it above where the water is taken, from those that come into it below the intake. Those below the intake are the Yedding, Brent, Lea, Roding, Darent, Ravensbourn, Wandle, and Hogg's Mill. The tributaries of the Thames above the intake of the waterworks companies are the Mole,* the Wey, the Loddon, the Kennett, the Cok, the Cole, the Ray, the Colne, the Thame, the Cherwell, the Evenlode, the Windrush, the Coln, and the Churn.

On the Thames and its tributaries above the intake of the waterworks companies—subject to the note we have made on the Mole—there are 1,001 distinct places of settlement, containing a population of 888,088, including 89 towns above the number of 2,000 population. Of this population of 888,088, 179,884 are situated on the banks of the river, or on tributaries immediately at their junction with it, and after making every allowance for retention in cesspools and for villages and houses removed from the banks of the river or its tributaries, the number of persons whose sewage daily finds its way into the water from which London principally draws its supply, amounts to hundreds of thousands.

As the sewage travels down with the flowing water of the river, a process of oxidation goes on, which tends to purification. The volume of sewage is small as compared with the volume of the river; and upon analysis the water pumped into London proves to contain only a very limited quantity of organic matter. But neither the one nor the other is satisfactory ground of assurance that the metropolitan supply is wholesome. The process of oxidation which the sewage more or less undergoes in its course is no sufficient guarantee of its arriving at Hampton purged of its injurious sewage taint. The London drinker of Thames water may be drinking with it some remnant of the filth of Oxford.

Again, it is the general opinion of medical men that what causes the presence of organic matter in water to be poisonous is not its quantity, but its quality; and this special quality cannot, as yet, be detected by either microscopic or chemical analysis, and is indeed at present known only by its occasionally noxious effects.

The result seems to be that as a water supply the Thames, polluted with the sewage of the inhabitants of the river basin, is open in kind, if not in degree, to the same objections as well-water infiltrated by liquid from an adjoining cesspool. Well-water so tainted may appear to sight, taste, and smell to be harmless, and has been known to have been drunk for a length of time without apparent mischief; but beyond all doubt that same water is liable, under particular conditions, to become poisonous.

Oxford and Reading add largely to the pollution of the river; and Windsor and Eton, being more thoroughly drained, pour out continuously a much larger proportionate volume of sewage. The amount of pollution from Cirencester, Cricklade, and Lechlade, is apparently small, though it is impossible to estimate the amount of liquid which finds its way from cesspits into the river.

Where the sewage is drained into the river, much of the flocculent insoluble matter floats down the stream until caught by vegetation or deposited on the banks. The weeds and banks for a considerable distance thereby acquire a disgusting slimy appearance, and when exposed to the sun smell most offensively. The rest of the insoluble part of the sewage accumulates in the bed of the river at or near the point of discharge, and there lies, a mass of putrescent matter, sometimes of many feet in depth, until stirred up by boatmen or raised in the form of the gases of putrescence, giving off an offensive exhalation, or is swept down by floods, and its corruption transferred to the banks at a lower part of the river.

The foul condition of the outlets of the sewers at Oxford and their noxious effects upon residences in the vicinity are described by Professor Daubeny and Sir Benjamin Brodie.

At Windsor, Mr. Menzies says that in dry weather a nuisance occurs where the sewage is discharged into a river with a current as slow as that of the Thames. "There is a bend in the river immediately below the mouth of the sewer which has the effect of sweeping round all floating filth and lodging it against the bank; people have to be constantly employed to push it with rakes from this bank into the stream. The solid parts of the sewage float and keep on the top for about three miles down the river, until they lodge against something, and there become dissolved."

At Kingston the sewage is still discharged into the river, and although Sir W. Page Wood, the late Vice-Chancellor, refused to grant an injunction against the corporation, on the ground that a nuisance had not been proved, it needs only a reference to his judgment to prove, what is notorious, that a "nuisance" is a relative term. The Thames above Kingston was already fouled by sewage. It received the sewage of Surbiton immediately above Kingston, and about one-half of that of Kingston above the point where the new outfall was made; and merely to intercept the former by many outlets, and discharge the sewage at one outlet lower down, formed no sufficient ground for the interference of the Court. The case, therefore, properly understood, proves that the Thames was foul before rather than that it would be fouled by the additional influx of half the sewage of Kingston.

It should be stated, however, that both Kingston and Surbiton are below the intake of the waterworks companies.

Richmond, being within the tideway of the Thames, has its sewage thrown back upon it, and not only its own, but that of the towns lying between it and the metropolis. In addition to this the low-water level has been somehow permanently lowered at Richmond, and so a larger area of foreshore is exposed when the tide is out of the river. The low-water level at Richmond is now 3 ft. lower than it was formerly. This is variously accounted for, but the Commissioners are convinced that it is in consequence of the removal of old London Bridge and the constant dredging between that point and Putney, causing the stream now to run down from Teddington more quickly.

The navigation between Putney and Richmond was always a tidal one, but the period during which barges can pass and repass is now still further reduced. The channel available for boating purposes is considerably curtailed. Residences on the river's edge, once constantly accessible by water, are now at low tide cut off from the stream by an unsightly interval of offensive mud. Nuisance from sewage is greatly augmented. Not only is the stream more fouled by the volume of sewage thrown into it having increased, but the banks on either side are to a larger extent laid bare, and covered with sewage deposit.

In the manufacture of paper a large quantity of water is used in washing the fibre, nearly 250,000 gallons to each ton of paper; and in consequence of that being requisite, more than for the advantage of water-power, paper-mills are always located where there is plenty of water, and those in the Thames basin help to pollute the water of the river and its tributaries, although in a secondary degree to the pollution by sewage. There are not many paper-mills on the main stream; they are chiefly on the tributaries, where the water is purer and more suitable for the purpose.

The other special subject of inquiry was—"The effect on the drainage of inhabited houses and lands, of obstructions to the natural flow of the river caused by mills, weirs, locks, and other navigation works, and the best means of remedying any evils thence arising."

* Two of the companies take their water below the Mole, but the other companies who take water from the Thames — viz., the West Middlesex, Southwark, Vauxhall, and Grand Junction—take it above the entrance of the Mole, and in any question affecting their interests in respect of the impurity of the water they supply, it is but right that this should be stated.

The interests connected with weirs are conflicting. Those of the owners of land adjoining the river and those of the navigation are directly antagonistic. The landowner requires the water to be kept down so as to afford an outlet for the drainage of his land; the navigation interest is to keep it up so that there may be a sufficient depth of water in every reach, from weir to weir. The owner of a fishery requires it to be penned up temporarily and then let go, the fish running with the stream being caught in "bucks" placed in the weir.

The interests of the miller agree so far with those of the navigation, that both require the head of water to be kept up in general, but the miller sometimes wants it drawn down so as to use more of the water for a short time than the ordinary flow yields. This is just before the time when he expects a flash to come down, which will again raise the mill-head quickly. This system of flashes is carried on chiefly in the upper parts of the river, where the navigable channel is defective. The water is let go from weir to weir, at intervals, to carry barges over the shoals on the wave thus caused, and the time being known approximately when this accession of water will take place, the miller for a short time previously makes too free a use of the water, and then impounds the flash. But he sometimes disagrees with the interests of the navigation in not passing on the water so soon as the barges are ready to pass on.

The water of a flash sometimes rises so high as to flood the land, and here the miller is on the side of the navigation as against the interests of the riparian proprietors. The millers again are diverse in their own respective interests. A miller increases his own head of water at the expense of increasing the height of the tail water of the mill above him, and so reducing its fall, while he sends down the water he uses, regardless whether the miller below him is ready to use it.

At the time this report was made, May, 1866, the upper part of the river, *i.e.*, from Staines to Cricklade, was under the management of the Thames Commissioners, a very numerous and heterogeneous body, deriving their powers from Acts of Parliament, the first of which was passed in the reign of King George II., while the Conservancy Board date their powers back only to the year 1857. Since this report was made, the Thames Commissioners' powers have ceased in respect of the river, and the management is now placed in the power of the Conservancy Board from the mouth of the river to Cricklade.

The Commissioners draw attention to the fact that this report does not deal with the tributaries of the Thames, but this omission does not invalidate any of their suggestions; and had the delivery of their report been postponed till the inquiry into the state of the tributaries had been completed, it would have been too late to have been of service in any scheme providing for the immediate necessities of the upper navigation. For the same reason, the question of water supply and storage reservoirs has been left for subsequent consideration.

As to the latter subject, we may remark that it has recently been dealt with by another Royal Commission in a report of which we gave a *résumé* recently in the *Builder*.

In looking at these two reports, it seems on the whole preferable to draw a supply of water for a town from an unpolluted source, rather than set one chemist's opinion against another's as to the salubrity of the water we drink or otherwise, and try to find by a majority of testimony whether a water like that of the Thames is a fit and proper source of supply.

If sewage is to be kept out of the river, the question is, of course, what is to be done with it? and, although the "sewage difficulty" has been so long on the *tapis*, we will venture to recur to the subject of the disposal of town sewage as reported upon by the Royal Commissioners. They say that they agree with a report that had been made previously by a separate commission appointed to inquire into the best means of distributing the sewage of towns, the gist of which is that "the right way to dispose of town sewage is to apply it continuously to land, and that it is only by such application that the pollution of rivers can be avoided."

The Commissioners say that cesspits in towns corrupt the air and corrupt well-water; they are incompatible with health, and should be done away with. All attempts at deodorisation or disinfection have failed. As an instance of the beneficial use of sewage on land by irrigation Croydon is adduced (since this report was made other places attest the propriety of this mode of disposing of sewage; Bedford and Banbury, for instance), and it is curious that the Commissioners in this report say that there were at that time, 1866, some objections raised against the practice of irrigation by Dr. Cresswell, a local practitioner, who thought that some peculiar cases of illness resembling ague that had occurred in the district near the irrigated land at Croydon, might have been caused by miasma from that land. Now, in the present year, an inquiry took place at Kingston as to the desirability or otherwise of irrigating some land in the immediate neighbourhood, and Dr. Cresswell was brought as a witness in favour of the scheme, in consequence of his having since found that he had been mistaken in his former opinion in respect of sewage irrigation, and has now satisfied himself that it is harmless when properly conducted; that is, kept constantly moving, and never allowed to stagnate.

Mr. Reynolds, who resides near the outfall of the Beddington irrigation, says he occasionally finds a smell; but, on inquiry, always finds it has been caused by neglect of the workmen to keep the sewage in motion over the proper areas of land. The same land will serve the purpose of sewage irrigation continuously. The process to the soil is one not of exhaustion, but of constant renovation. Sewage can be pumped any height and carried any distance. Its conveyance, therefore, to any point is merely a matter of cost. There is no real difficulty in dealing with sewage. On a clay soil, or wherever pumping is necessary, it is desirable to restrict the dilution. On a gravelly porous soil, on the contrary, as shown by Mr. Marriage, it is an advantage that the sewage should be largely diluted, since it is then much more readily distributed over the surface. If a farm be large enough, there is no time when some portion of the land may not be capable of receiving the sewage. The process of irrigation may go on day and night, in wet and drought, in summer and in winter. Sewage must be applied to land while fresh, not allowed to stagnate anywhere; and then there is no smell, the soil seizing upon the constituents and appropriating them to the uses of vegetation, and preventing the escape of foul gases into the atmosphere.

Filtration is not applicable to sewage. Town sewage cannot be filtered through an ordinary sand-filter, nor is it necessary in any case to attempt it. Deposition and separation of grit and flocculent matter are alone required.

The most profitable way of applying town sewage by irrigation is to sow Italian rye-grass, and to sell or use the crops fresh cut for horses and cows. A field will in a year produce four or five crops, and 50 tons per acre have been grown in the year. But root crops and cereal crops are also beneficially grown with sewage. At Lodge Farm, near Barking, nearly every description of crop is grown with sewage by irrigation. For other than grass crops the sewage cannot be so freely or so often applied, and therefore a grass crop should form the staple; but sewage irrigation promotes the growth of all kinds of vegetation; and, where plenty of land is at command, any kind of crop may be grown with it. At Lodge Farm a large number of milking cows are kept on the premises, and fed with the grass cut fresh.

Apropos to this subject, Mr. W. Hope writes a letter to the *Times* of August 12th last, in which he says, "Italian rye-grass is worth to a dairy-farmer, who sells his milk as milk, or who makes it into butter to be sold fresh, 15s. a ton. It is unnecessary to take into consideration farmers distant from towns, who are compelled to turn their milk into cheese, because a farmer within reach of sewage is within reach of his market."

STRIKING NOVELTIES AT SOUTH KENSINGTON.

A remarkable peculiarity distinguishes the South Kensington Museum from other exhibitions, temporary or permanent. Its warders never sleep. Constant novelty—ever recurring change—is the law of the place. New objects of wonder, of beauty, or of luxury, are ever and anon making their appearance in the courts more especially devoted to the Loan Collection, which, when you seek to revisit, you find in their turns replaced by others of no less interest. Certain grand forms of Ancient and of Mediæval art—the colossal Melpomene, the gigantic David, the majestic Moses—look down in unchanging grandeur on a constant whirl of minor but not less beautiful objects. The *cachet* of the first Exhibition, the unrivalled and wonderful scene of 1851, seems to linger in the halls of its offspring, the Art Museum.

Since the halls and courts of Kensington were thrown open to the numerous and brilliant assembly that did honour to the invitation of the Council of the Society of Arts early in July, some striking additions have been made to the contents of the Museum. In *terra cotta* we are presented with rare and beautiful relics of the art of Magna Grecia, as well as with the results of the latest improvement of contemporary manufacture. From Japan we have one of the most perfect examples of the counterfeiting of nature which Oriental skill and untiring patience have yet produced; and the present happy juxtaposition of two Madonnas by Raffaelle—one the property of the nation, and one exhibited on loan—is an occasion such as no lover or student of the works of that most *spirituel* of painters should fail to seize.

Indeed, the noble room in which are displayed seven original cartoons, together with the actual tapestry representing the committal of the keys to Peter, possesses an unusual claim to the appellation of the "Raffaelle Saloon." It is rich in relics of *Il Divino*. The great chalk drawing of the Transfiguration, executed from the original by John Casanva, is a work of the highest value, and of extreme beauty. It would be in many respects desirable that the magnificent tracing of the Sistine Madonna,—the finest picture, beyond dispute, in the world,—could be removed from its altogether unworthy position on the staircase of the National Gallery, and hung in this saloon. Then we have the exquisite pilasters of the Loggia,—arabesques, and flowers, and birds, and human forms,—treated in a style which unites the quaintness of northern art to the love of beauty characteristic of southern climes. There are ten paintings from the Frescos in the Vatican, together with the conventionalised but marvellous scenes from Scripture history that recall the name of "Raffaelle's Bible." Then we have a *Terra Cotta* sketch for the marble statue of the Jonah in the Chigi Chapel, in the Church of Santa Maria del Popolo, at Rome, a work which it is interesting to compare with the wax and clay models from the hand of Michelangelo in the court below. The Emperor of the French has contributed a magnificent specimen of the modern *Gobelins* tapestry,—a Holy Family, after that by Raffaelle in the Louvre. The exquisite beauty of the face of the Madonna is such as to lead one to realise and to understand the importance which, in days when the sewing-machine was not, was attached to the instruction of high-born and delicately-nurtured women in needlework. It is more than questionable whether so perfect a representation of living female beauty could be produced, either in fresco, in oil, in water-colours, or even in crayons, as that which has been here wrought by the graceful fingers of the French women of 1856.

At a moment when questions as to the authorship and the authenticity of pictures, purchased at a very large sum, are so freely debated by the press, and even in Parliament, it is especially instructive to note the vouchers of the two Madonnas hung in this noble company. One of these, the Townsend bequest, was purchased by the Right Hon. H. Hare, at the sale of the collection of the Duc de Massa, after that officer's death. The name of Regnier, Duc de Massa (who, like his kinsman the Comte de Gronau, was one of the Buonapartist mushroom creations, and no relation of the very ancient noble family of Reignier), may be held to bear witness to the value of those works which he, like others of his fellow troopers, "collected" with such facility during the Imperial wars, in which what vulgar people call thievery was quite *selon les règles*. There was no time to manufacture originals, or to "discover" antiques for the grasping hands of the invaders; and notwithstanding all promises of restitution, much of the plunder of Italy never returned from Paris. As to the sister picture, the property of Mr. Verity, the evidence is unusually full and complete. The records of the monastery of Vallambrosa speak of the payment, in eleven instalments, of the sum of sixty gold florins, together with a cask of wine, to the painter. The *Libro di Ricordanze* of the Institution mentions the picture down to the year 1808, when the monasteries were suppressed by the French, and the Madonna was "acquired" by M. de la Fôret, a gentleman in the service of the pseudo-King Joseph of Naples. This gentleman had it transferred from panel to

canvas, and it passed from the hands of his widow into those of the present owner thirty-four years ago.

The contrast between these noble works of the great Master is highly interesting and instructive. The condition of the two pictures differs in some important respects. In each the original azure of the distant landscape has faded into a sort of grey. Viewed closely, the flesh of the Vallambrosa group is somewhat—we must use the word—grubby; it asks to be cleaned, if cleaning were all that would result from the process. The Townsend Madonna appears to have undergone this peril without disaster, unless it be to the landscape. The limpid purity of the flesh tints, the perfect beauty of the left foot of the Virgin, and the grace, tender and significant, of the pose of the infant, standing on the naked right foot of his mother, are truly characteristic of Raffaelle. The expression and outline of the face, however, in the children no less than in the mother, are inferior in dignity and in beauty to those of the companion group in the Vallambrosa "Holy Family," which, though less brilliant to the eye, is by far the finer picture. Even here, however, the expression of the Infant Christ is as inferior to that of the Garvagh Raffaelle as if the child had been of a lower and different race. The latter is, as far as our knowledge extends, the most exquisite human infant ever painted,—for the infant in the arms of the *Madonna di Santo Sisto* is divine.

Turning to a more modern subject, we find the place of Mr. Woolner's marble statue of David Sassoon, which for some time stood under the shadow of the great Melpomene in the North-west Court, filled by a very remarkable work of art. The *soirée*, to which we before alluded as held by the Society of Arts in the courts and galleries of the Museum, gave us the opportunity of seeing this marble by artificial light; the result being, as might have been expected, a further illustration of the truth of the important canon that no work "in the round" should ever be viewed except in the position, and in the light, intended by the sculptor. With much humbler claims to rank as a high art work than those which are instinctively admitted on behalf of marble, the porcelain Palissy comes before us with the dignity of some man of the people borne to unexpected power,—a Masaniello, or a Rienzi, or a Garibaldi. Call the figure a bit of pottery, if you will,—it is of a noble *pâte*. The back is somewhat unfinished, and very probably was not intended to be exposed to view. The texture of the doublet is somewhat questionable as to the material which it represents,—the full trunk hose are slightly open to the same objection; the stockings cling to the well-turned limbs with textile truth.

But as to the points on which the artist has exerted his higher skill, the verdict must be highly favourable. The face is not portrait, but idealization. The brow is thoughtful and well proportioned; the nose admirably modelled; the lips delicate and well cut. The hair and beard are good; they lack but a very little of being extremely good, and we think that little is rather the fault of the material than that of the artist.

With the hands we are less content. Not that they are not very distinctly and carefully treated, but they are not Palissy's hands. No man could have been an artist who had such rectangular fingers,—such square ends to them; such an elemental hand as is to be found only in a savage, or a man of the very rudest nature. For such a hand, too, the finger-nails are defined with too much sharpness. The sharp centering angle that marks the side of each almost filbert-shaped nail is, to our mind, inconsistent with the clumsiness of the joints. We believe that the hands have been modelled from imagination. If there ever was such a human hand, we cannot decipher what would have been the character of the owner. And what is the meaning of the sharp grip with which the finger and thumb of the left hand are squeezed together? Can it be that the great potter is represented as taking snuff? It looks horridly like it. Certainly that delicate nostril was never so misused.

Notwithstanding these minor criticisms, the statue marks an era in industrial art. The fine glazed white biscuit of which it is composed offers almost as fair a surface as marble, and is far preferable to marble when deformed by veins, or by the appearance of something like the blue mould in cheese. For our angry climate, and for any situation even partially exposed to the weather, the introduction of the material is a great boon. We must not forget that we have been applying a criticism by which not even Luca della Robbia would be unscathed; the difficulties of the task are immense; they have been nobly grappled with, and, in the main, admirably surmounted.

A small furnace at the base of the figure bears the inscription:—"C. Levy, *exécuté pour la musée de Londres* (the ordinary French scorning of English detail). Poyard, Vion, Baury, *fait à Paris*, 1869." Palissy holds in his right hand one of his well-known dishes, embossed with reptiles, although not stamped with the natural vigour of his actual work.

Turning our attention backwards from Mediæval to ancient pottery, we read that the rare beauty of the objects occasionally found in that part of the Italian peninsula which was known by the name Magna Grecia, is but little known in this country. The Sicilian kings of the House of Bourbon, in whose blood there lingered a love of art that ever and anon broke out, now in worthy, now in grotesque activity, were so far aware of the fertility of this ancient mine as to insist with great precision on the right of the Crown (that is, of the reigning monarch) to all such treasure trove. Even in the concession of the railway from Naples to Brindisi a clause was inserted to maintain the rights of the king to all objects of antiquity found in the prosecution of the works. Thus in the fine terra-cotta fragments found at Canosa (the Bilingua Canosa of Horace's journey to Brundusium, where the bread is even now as gritty as it was in the days of Augustus), which Signor Castellani has lent to the South Kensington Museum, we have something rare and novel, as well as interesting from its intrinsic excellence.

The objects in question are for the most part of grey *terra-cotta*, many of them having been painted in different colours. In some the original tint seems to have been a pale red. The largest object is a globular vase or jar, of the form called *ascus*, with circular spout, and depressed, strap-shaped handle above. It is ornamented by masks of Medusa and other figures; and is in very fine condition. The date of the entire collection is stated at about 200 B.C.

There is another vessel, probably for mortuary purposes, with a lid ornamented with figures, of the form of a gigantic cold-cream pot, except that the lid overhangs the drum. Two curious masks, with a figure standing on each, and a strap-shaped handle behind the figure, seem to have been the covers or tops of vases or ewers of some description. Three statuettes of females, in short cloaks above the under garment, one with a hood, and all with the hair arranged in a close approach to the present fashion, are also noteworthy. Smaller figures may be regarded as *lares*, or memorials of the departed. There are also a few terra-cotta plaques, of inferior workmanship, which are said to have been found at Capua. But the chief glory of the collection is a group of male statuettes of men, horses, and other animals, engaged in a chase. The detached figures only have been preserved. They appear to have formed a sort of double band or frieze round a vase, or some similar vessel, which, if such were the case, must have been an object of no ordinary beauty and value. The fragments are much damaged, and probably were never very delicately finished, but the spirit and movement, in a word, the *go* of the entire group is wonderful. We can call to mind, at the moment, no exact parallel. The stag tosses his head as if he had been that moment transfixed by an arrow. Near him a man throws out both hands as if to exclaim, "Ferito, ferito." Another figure stumbles and falls, with perfectly natural awkwardness. A man on horseback, looking over his shoulder, gives to his *monture* the air of a donkey. The bridles of the horses are adorned with the bosses and knobs to be found in the country at the present time; a cumbrous, heavy bridle, pressing on the nose, and with no bit in the mouth. A wild boar stands at bay viciously; and this little bit of Greek life comes out from the fragments of what was a great work of art 2,100 years ago, with a freshness as of to-day.

Interesting as is the comparison of examples of the earliest and of the latest exercise of ceramic art, a yet more striking contrast may be found, beneath the same roof, between Italian and Oriental *chefs d'œuvre*. From the ideal portraiture of the Holy Families of Raffaelle, we are enabled to turn to one of the most emphatically realistic productions in the world. We refer to the Japanese painting on silk, representing a tiger crouching and clinging on a tree. It is very much to be suspected that the silk (which is adorned by a pair of very incongruous bands of purple and gold arabesques above and below, though not on either side) has been dressed with a paper pulp, or in some similar way prepared for the colour. The tree on which the creature is perched, and the waterfall close by, are so Japanese as to require explanation, as they by no means convey to the English spectator the idea of either wood or water. But the marvel and miracle of the matter is the fur of the tiger. It is almost impossible to believe that it is only a representation. You find yourself blowing on the frame, and tapping the glass with your finger, to disturb the hairs. The closer the magnifying-glass is brought, the more perfect is the deception. Were it not that the artist has been entirely neglectful of shadow,—so that none is cast by the terrible, cruel paw, and so that it is impossible to distinguish the outline of the back of the head from the neck, or rather shoulder of the mighty Cat,—the portraiture would be closer than a photograph. Each individual hair of the long fur has been portrayed. The little radiating points, or "crowns," on the shoulder-blades, from around which the fur falls away in every direction, are so marked, that you note the soft undergrowth of the hair. The expression of the face of the brute, with its large eyes, like rough, uncut emeralds, its open mouth, and glistening *carnassier* teeth) is such as to give the impression of the head of a snake. The tip of the tail, curling from beneath the tree, resembles pretty closely that of an ermine. Pass from a contemplation of this wonderful coat to that of one of Landseer's noble dogs, in the picture-gallery, and you find that however we may pity or affect to despise the narrow conventionalism of the Japanese artist (his name is Gauko, and his date was A.D. 1700), the coats of the animals depicted by the great English master—and we use the expression in perfect good faith—look like mere daubs of paint when viewed with the same minute attention that is again and again deceived by that matchless fur.

Certainly the close of the season may be said to be heralded at South Kensington by a very brilliant display of novelties.

ERWIN VON STEINBACH AND HIS WORKS, IN STRASBOURG, THANN, AND FREYBURG.

Strasbourg.—On arriving at Strasbourg, and finding himself, for the first time, face to face with the great cathedral,—indisputably Erwin's master-work,—an art-student is involuntarily moved by a strong and yearning desire to know all, and more than all, that either record or tradition has preserved concerning the life and works of the great artist-mason; and he at once sets to work to hunt out all that can be learnt of the career and genius of the great artistic magician who, in the midst of what some have been pleased to call dark and barbarous times, was inspired, not only with the daring to conceive, but also the consummate skill to carry into practical execution, one of the most marvellous architectural dreams that ever stirred the teeming fancy of a great and enthusiastic artist; a dream of exquisite combinations and marvellously intricate details, which were not destined to remain merely ideal, the "airy fabric of a vision," but to be developed by the cunning of his head and hand into a vast lace-work of indestructible stone, and to remain through the long course of centuries one of the most wonderful monuments of the daring and energetic art-spirit of the Middle Ages. It was under the influence of an active curiosity thus aroused that the materials for the present incomplete and fragmental notice of the life and works of the great Gothic artist were collected and strung together.

In endeavouring to estimate the share of glory in the production of the cathedral of Strasbourg, which is the just due of Erwin of Steinbach, it becomes necessary to assess very carefully how much ought to be conceded to his predecessors and followers. Such vast works as the great Mediæval cathedrals were in almost every instance the result of the successive labours of several generations of architects, and yet it not unfrequently occurs that one great artistic name of more than ordinary celebrity absorbs all those that either followed or came before in the work; as, for instance, in the building of St. Peter's, at Rome, the vast fame of Buonarotti has swallowed up nearly the whole of that which was due to Brunelleschi, Bramante,

San Gallo, Vignola, Maderno, and many others; even that of Raffaelle himself among the number. Such, however, is not the case with regard to Erwin and the cathedral of Strasbourg. It is true that he had able coadjutors and still abler followers; but, after he had once taken the great work in hand, he may be said to have made it his own, and it was, in the main, in strict accordance with his designs alone that all future operations were carried forward. His master-share in the great work may be clearly traced by the characteristics of his peculiar and well-marked treatment of the Gothic style of his epoch; and it may be roundly asserted that by far the greater part of the vast structure bears the impress of the unmistakable signet which has stamped his well-defined individual style. The share of artistic merit and originality due to his predecessors and successors is equally well defined, and a careful estimate of the claims of each leaves, plainly enough, the chief glory to Erwin, and to no other.

The site of the present cathedral, now near the centre of the city, was originally occupied by a pagan temple, which Clovis is said to have converted into a Christian church about the close of the fifth century, that was greatly enlarged by Dagobert about a century later. That edifice, constructed in great part of wood, was eventually destroyed by fire, and several succeeding structures, raised upon the same site, were in their turn destroyed, either by fire or lightning, or by the ravages of war. It was not till the middle of the eleventh century that the nucleus of a building was raised, of which the present cathedral may be considered the ultimate development. At that period Bishop Werner, of Hapsburg, commenced the plan of a truly grand edifice, vast in its proportions and magnificent in the forms of its projected elevations,—a structure which, had it been promptly completed, before the Germanic style of that period gave way to the development of lighter and more ornate schools of Gothic art, would have added one more to the list of great Romanesque churches, such as those which form the chief architectural glory of the Rhine country and the neighbouring regions. That it was intended to be of truly colossal dimensions is seen by the proportions of the gigantic columns at the intersections of the transept, which are among the undisturbed and unaltered features of the building commenced at that epoch.

A variety of interrupting circumstances which succeeded each other with scarcely any intermission, prevented the advance of the works so ambitiously commenced by Bishop Werner, and they had, in fact, made no really hopeful advance towards completion, after two centuries of struggling but ineffective endeavour. At that period, however, an entirely new epoch was about to dawn upon the cathedral of Strasbourg. In 1276 the Bishop Conrad of Lichtenstein determined to make a great and energetic effort to complete the great episcopal church. He called upon Erwin of Steinbach, whose skill as an architect, and still more especially as a sculptor, was becoming celebrated all over Alsatia, to produce a grand and comprehensive plan for that purpose; and Conrad and Erwin being both men of energy and action, there was at last a fair prospect of the work being carried forward rapidly to completion, and no time was lost in taking the first steps necessary to the fulfilment of their common object. The period was precisely that at which Gothic art had attained to its greatest excellence—a truly classical period (if that term may be used) in the progress of its manifold developments. The architectonic sculpture of the period even rivalled that of the best days of Greece, after its own peculiar theories of the beautiful; for it thoroughly succeeded in fascinating the beholder by the quaint and charming *naïveté* of its conception and treatment, and, perhaps, gained in that direction more than it lost by the absence of the grand idealistic graces of the Greek and Roman schools.

The main architectural features, with their subordinated enrichments of delicate ornamentation, had also reached a climax from which they afterwards declined; and the magnificent plan produced by Erwin at the command of his bishop proved him to be one of the greatest masters of his art at that great period, the final developments of which had probably owed some of their most beautiful characteristics to the special influence of his own works.

Bishop Conrad, fully appreciating the wonderful excellence and completeness of Erwin's grand design, and perceiving, at the same time, the vast amount of labour that would be required to carry it into effect, felt that more than ordinary efforts must be resorted to for that purpose. Under these convictions, he despatched proclamations to all parts of Europe promising "indulgences" and other ecclesiastical inducements to all who should at once come forward and energetically assist in carrying the magnificent plan of Erwin of Steinbach into execution. From the chronicles of the time we learn that the appeal of the bishop was enthusiastically responded to, and that such great numbers flocked to the work under the influence of the proffered inducements, that the city of Strasbourg exhibited a most extraordinary and unwonted spectacle on the sudden assembling of a vast multitude of artists, artisans, workmen, and unskilled labourers of every description, of both high and low degree, all anxious to commence the vast undertaking. It will be seen by this statement of the chroniclers that the army of volunteers thus suddenly assembled to commence and carry forward the great work was not solely composed of skilled artisans of the various classes required, but also of vast numbers of all classes, anxious to work as common labourers in what was deemed a holy cause; and we are informed that even women and children were among the number of those assembled—each eagerly impatient to aid in the great undertaking according to his strength and capacity, utterly regardless of rank, station, age, or sex.

This multitudinous enthusiasm was, however, soon proved to have its inconveniences as well as advantages, as may be seen by the following graphically recorded incident. When all had been prepared under the directions of Erwin for the laying of the corner stone, and the bishop himself had performed his part in the ceremonial by digging out the first spadeful of earth, several enthusiastic master-masons rushed forward at the same instant to secure the highly coveted honour of digging the second, and the two foremost being equally determined not to give way, hard words ensued, which led to harder blows, and the weapons being heavy iron spades the contest soon terminated fatally for one of the combatants. This untoward event was regarded as a bad omen; and a great discouragement fell upon the assembled multitude; but the bishop having announced his determination to devote nine days of continual prayer to the purification of the spot, and carried his declaration into effect, it was believed that the evil augury was removed, and the work was recommenced with undiminished spirit and determination. The accident was, indeed, turned to good account in the form of a fortuitous stimulant; for a band of priests, who were always present to incite both artist and labourer to the greatest possible amount of exertion, ingeniously compared the event which had just occurred to the story of Hiram, at the building of the temple of Solomon, who, according to the sacred record, was slain by his fellow architects, who were jealous of his superior skill. This kind of encouragement is said to have told with wonderful effect, for the men belonging to the guild of masons were well versed in Scripture reading, and fully appreciated and relished the analogy thus set before them. The story of the building of the Temple of Jerusalem was, indeed, still further utilized after the same fashion, and the high rewards bestowed upon its constructors unctiously dwelt upon, especially those apocryphal ones described in the Mediæval legends which in Roman Catholic countries have so closely associated themselves with the Biblical account of the building of the Temple.

Erwin was aided in his great undertaking by his sons, John and Wynkin, and also by his daughter, Sabine, whose features and figure are said to be reproduced in several of the graceful statues of female saints which enrich the decorative portions of the cathedral, and more especially in the delicately sculptured figures of the "wise virgins" in the niches of the great portal. Several of these are traditionally asserted to be her own work, for it was in the higher kinds of decorative sculpture that Sabine is said to have chiefly excelled. The general style of the extensive works undertaken by Erwin in order to carry the structure rapidly forward on its way towards completion are, naturally, stamped with the general impress of the phase of Gothic art which developed itself during the last quarter of the thirteenth century; but in general richness and infinite delicacy and refinement of detail it exceeds most other examples, and marks a decisive advance towards the more florid development of the fourteenth century, during which, in fact, the greater part of the design was carried into execution.

In this great monument of Gothic art, not only do the lateral portals and those of the principal façade exhibit an excessive richness of design, but the whole external surface of the structure is elaborately enriched with delicate ornamentation in almost equal excess. The feature of detached columns in front of recessed portions of the work, such as windows and niches, which was one of the most charming general characteristics of the more richly decorated works of the period, is more profusely and delicately carried out at Strasbourg than in other great works of the same epoch. Erwin has, indeed, made this feature a very leading one in his system of external ornamentation, insomuch that the vast number of detached columns, delicately slender, and combined with attendant ornamentation, might almost be compared to a profusely embroidered veil cast delicately over the entire face of the building. So delicate, indeed, is this profuse display of detached column-work, that one can scarcely understand how it should have withstood the wear and tear of time and tempest, in a severe climate, at the foot of the Vosges mountains, through a course of 600 years, with a comparatively small amount of injury. Yet this slight and almost detached work has, in fact, stood better, in many places, than the more solid portions of the building, and seem to require less renovation in the course of the careful restorations that have been in progress for several years.

The architectural critic Milizia speaks of the cathedral of Strasbourg as resembling in many respects those of Paris and Rheims, "*e d'un gusto consimile a quello di Rheims e di Parigi;*" but the resemblance is by no means so great as might be inferred from the words of the Italian critic, its far more lofty proportions giving to it a general character very distinct from either of those well-known structures. For instance, the tops of the towers of Notre Dame are scarcely higher than the upper line of the main façade of Strasbourg, before the commencement of the upper part of the tower and steeple; the total height of the Parisian structure being about 202 ft., while the general mass of the main façade of Strasbourg is near 200 ft., and the total height of the building to the top of the steeple is 436 ft.* It is this great elevation which removes it beyond the sphere of comparison with almost every other architectural structure in Europe; and we therefore find it occupying a prominent position in those diagrammatic compositions in which the relative heights of the greatest edifices of the world are estimated, and in which the height of Strasbourg challenges even that of the great pyramids of Egypt. It is, indeed, one of the most remarkable of the gigantic temples which the spirit of Christianity produced through the medium of the earnestness and enthusiasm of the great masonic architects of the Middle Ages. Felibien, in his "*Recueil Historique de la Vie des plus célèbres Architectes*," asserts, in his brief outline of the career of Erwin, that all the thirteenth and fourteenth century work of Strasbourg Cathedral must be attributed to the designs of that great artist, although he did not live to see the whole of his plans carried out. And Felibien is no mean authority, for although an architect of the most rococo school of Louis XIV., at a time when Le Pautre was putting the finishing touches of his *bric-a-brac* fancies to the palace and gardens of Versailles, he had nevertheless a fine capacity for judging liberally, broadly, and critically of the architecture of all styles and ages. He was, in fact, a true cosmopolite in art, and expresses his regret, while speaking of the beauties of Strasbourg Cathedral, that he has not sufficient space at his command "pour faire connoître avec quel art et quelle magnificence on batissait alors en diverses lieux d'Allemagne et en Angleterre;" while he frequently expresses great and genuine admiration of the architectural monuments erected by the Moors, which most of his contemporaries looked upon as neither more nor less than absolutely barbarous.† When the French critic goes on to speak in some detail of Strasbourg, he says, "On ne voit guère d'édifices Gothiques plus grands ni mieux construits," exclaiming, "On ne sçaurait bien connoistre la beauté de cet ouvrage sans en voir an moins le dessin." He then enters

* Felibien states the height of the spire of Strasbourg to be 480 ft.

† Felibien's interesting work was published in 1696, and dedicated to the minister Louvois.

into many interesting particulars which have been made use of by Milizia without acknowledgment,—especially those relating to the relative proportions of contemporary Gothic edifices. Milizia also appropriates the passage of the French biographer in which he states that the architect introduced his own statue among the decorative sculpture of the interior of the cathedral, describing the precise spot where the effigy of Erwin might be seen against the upper part of one of the great pilasters; from which position, on the level of the upper range of gallery-work, he appears in the attitude of taking a general survey of the interior of the building. The intelligent biographer, Felibien des Avaux, who relates to us these interesting facts, was born at Chartres, and it may be that the remarkable cathedral of that city first aroused in him that general love of architecture which not only determined his choice of a profession, but at the same time developed that enthusiastic appreciation of Gothic art in particular which was so unusual in his time, both with architects and their patrons, that many most noble Gothic interiors were entirely encased in work of the fashionable Franco-Italian style of the Louis XIV. epoch; in which Vandalic process corbeilles, canopies, statuettes, and tabernacle work of the most exquisite kind were ruthlessly chopped off close in order to make a smooth and convenient surface for the reception of the fashionable stone or stucco-work of the time, which was destined to form a courtly garment of white and gold, after the manner of the glittering chapel of Versailles.* Perhaps even Felibien himself may have been active in desecrations of this kind, when tempting "jobs" turned up; but however this may be, he was a genuine admirer of the great Gothic cathedrals. After describing the statue of Erwin, he goes on to state that among the more noticeable statues were the three equestrian figures of Clovis, Dagobert, and Werner of Hapsburg, the most illustrious among the successive founders and refounders of the cathedral. Such statues, as the works of Gothic art, are extremely remarkable and interesting; equestrian statues being rarely found of such considerable dimensions. These were, no doubt, subjects upon which Erwin lavished much of his own artistic labour, and were deemed the chief pieces among the sculptures of the great work in hand. It is in unusual features of this kind that the student feels the greatest interest,—comparing them, perhaps, with the equestrian statue of St. Martin above the chief entrance to the church, dedicated to that saint, at Laon, or to the celebrated life-size equestrian statue of Stephen of Hungary, supported by a great projection of corbeille work against a massive group of columns in the cathedral of Bamberg; for, with the more general characteristics of Strasbourg Cathedral ordinary descriptions have already made him familiar. Among the external features, none strike the spectator more forcibly, or produce a more indelible impression upon the imagination, than the well-known exterior staircases, which, running up the angles of the towers, form a kind of perforated hexagonal turrets of the lightest and most attractive aspect, and are a peculiarly Erwinian feature, which, as will be seen, he was so well pleased with that he introduced it in subsequent works. The spire itself is also peculiar in treatment, the lower portion consisting of a series of pinnacles, rising one above another from the central cone, of acuminating stonework, until, within a certain distance of the apex, the cone itself becomes a grand central pinnacle or spire, formed of perforated work of very rich tracery. The general composition of this elaborate spire has been an object of admiration and curiosity ever since its construction, and the names of visitors of all countries are to be seen at the top of the internal staircase, more or less deeply cut in the stone, among which are those of Herder and Goëthe. The final *bouton*, or finial, which crowns this lofty spire can also be reached by external climbing, the only protection being obtained by means of small projecting iron bars, which the adventurer clutches with a feeling that a tight hold is his sole chance of safety; yet many have successfully scaled this giddy eminence, and while there broached a bottle of Alsatian wine to the prosperity of the good city of Strasbourg.

Among other points of excellence that cannot fail to strike a visitor, notwithstanding a previous general knowledge of the main characteristics of the structure, are the three portals of the great western façade, especially the two with the series of nearly life-size figures in the highly decorative niches, representing the "wise and foolish virgins," one of the subjects most favoured by the Gothic sculptors of Germany. In one of the niches devoted to the "foolish virgins" Satan appears in the character of the tempter, holding in his hand the typical apple. The Scriptural symbol of the serpent is most ingeniously blended, in Mediæval fashion, with the human form. As a tempter he presents a very pleasing and attractive front; but on looking to the back of the figure, the spectator perceives that its form is entirely composed of the coils of one or many serpents, the presence of which, it is supposed that his guile enables him to conceal from those on whom he is about to exercise the fascination of the tempter. The nearest of the virgins to this figure, the last among her companions remaining to be tempted, wears a self-satisfied smile as she meets the satanic advances, to the flattering blandishments of which she is evidently about to succumb, and adopt the pomps and vanities of the world which, under the symbol of the apple, are proffered to her. The features of those of her companions, who have already fallen away, are stamped with various degrees of despair and remorse, which the sculptor has expressed with wonderful art. This skilfully-wrought expression of the faces is powerfully supplemented by the apparent action imparted to the arms and hands, which is highly dramatic in character. It is true that the artistic treatment is marked by a certain stiffness inseparable from the naïve realism of Gothic art, but at the same time full of a certain charm of quaint simplicity which equally belongs to it, and which modern art, in its attempts at reviving the forms and treatment of Mediæval sculpture, has signally failed to reproduce. The placid beauty of the "wise virgins" in the opposite niches, forms an exquisite contrast to the remorse-stricken forms of their fallen sisters; the quiescence of their easy positions and the expressions imparted to their features of sweet and confident repose and hope, are of the highest kind of that truly refined art which the sculptor-masons of the thirteenth century displayed in their architectonic sculpture; and in more than one of them it is probable that we may trace the face and figure of Erwin's artist-daughter Sabine.

The central entrance, though perhaps still richer, is not so interesting in its statue-sculpture; and the feature which formerly gave to it a fitting pre-eminence—namely, the superb doors of bronze, celebrated masterpieces of the sculpture of the period—are no longer in existence, having been melted down during the French Revolution, in order that they might be coined into pieces of one and two sous for the use of the republican government.

The interior of Strasbourg Cathedral, even after the most careful study of the various published descriptions, never fails to produce a striking impression on the spectator, on account of its great height, which, from the floor to the centre of the groining of the roof, is said to be 230 ft.; a height so great that the towers of Notre Dame, of Paris, or those of York Minster, might stand within this lofty interior without touching the ceiling. This enormous height has afforded the architect the opportunity of introducing the line of lofty and splendid windows which form such a noble feature above the line of the clearstory, admitting a flood of light and atmosphere to the upper part of the vast interior which produces an unrivalled effect of brilliant lightness; while beneath these spacious and magnificently traceried openings a richly contrasting effect is produced by the smaller line of windows at the back of the double arches of the clearstory. It would be idle to attempt anything like a detailed account of the general ornamentation and decorative sculpture of this well-known and often-described work; but in its profusion of remarkable features each fresh visitor finds something new to dwell upon which has not been especially singled out for criticism or admiration by his predecessors. Among such special *morceaux* the writer of the present notice was especially attracted to the close examination of the exquisitely elaborated stone pulpit, which is perhaps one of the most intricately wrought pieces of delicate tabernacle work in Europe; and, although the treatment of some of the details would appear to suggest a somewhat later period for its execution than the time of Erwin, yet there can be little doubt that the design, in all its main features, and the disposition and proportions of its details, is due to no other, although his design may have been carried into execution, and perhaps modified by some of his successors in the great work.

There is also another feature, and that a peculiarly Gothic one, which has been wrought out with more than usual richness and success in this wonderful interior, namely the corbeille and canopy-work attached to the columns for the reception and display of statuary. This device for varying the ascending lines of lofty columns was certainly a most happy thought of the Gothic architects, and is the more interesting as being entirely absent in classical architecture, in which the moderate height of the columns does not, in fact, admit of its successful introduction. In the great Gothic cathedrals, on the other hand, this device serves at once as a point of agreeable repose to the eye in measuring the enormous height of the columns, and forms at the same time a most graceful and picturesque means of furnishing the edifice with all the convenience for a gallery of sacred sculpture without trenching upon and crowding up the lower portions of the space for the accommodation of the congregation. One of the most remarkably rich examples of such displays of statuary, supported on lofty corbeilles at the mid-height of the towering columns, to which they are made to appear almost necessary adjuncts by the addition of the elaborate canopy, is the series of sculptural figures, of life-size, and in fully-detached relief, which, tier above tier, cluster round a massive group of columns in the south transept, and which, in their own distinct style, form an architectural feature fully as striking as the celebrated spiral series of marble pictures which wind round the wonderful column of Trajan from base to summit. The lower set of figures clustered round that group of columns at Strasbourg consist of the four evangelists, supported on very magnificent corbeilles, the carvings of which represent, with a marvellous addition of intricate ornament, the well-known symbols of the four evangelists,—the angel, the bull, the lion, and the eagle. Above the figures are exquisitely-enriched canopies, surmounting which are four figures of angels, of remarkably fine execution, in attitudes of flying downwards, and in the act of communicating the inspired records to the authors of the Gospels. Above these is another tier of figures, the chief of which is the Saviour, descending from heaven, guarded by other angels. Such are a few of the more remarkable features of Erwin's great work, which, long before its completion, was awarded the first rank among the seven wonders of Germany.

* The writer has recently examined several interiors so treated, of which the cathedral at Wurzburg is perhaps the most notable example.

THE NEW OPERA HOUSE, PARIS.

As all municipal buildings have almost stopped work, the New Opera remains in almost the same state that it was in a few months ago, except the principal front, which, a few days before the 15th of August, was denuded of its box-screens, sheltering the four groups of statues at the entrances. These groups, one on each side of the doorways, are as follows: Music (by M. Guillaume); Lyric Prose (M. Jouffroy); Dance (M. Carpeaux); Lyric Tragedy (M. Perraud). Between these groups are four allegorical statues: Idyll, Cantata, Fable, and Elegy, the works of MM. Aicelin, Chapus, Dubois and Vatrinelle, and Falquières.

On the summit of the building, active operations are being undertaken to place the crowning statues, &c. At the angles of the façade, Lyric Poetry and the Muses occupy one; on the other are Lyric Poetry and the *Renowned*. These are due to M. Gumery. The colossal statue of Apollo, lyre in hand, has already been placed on the pediment of the great stage wall. It is by M. Aimé Millet, the artist to whom France owes the grand statue of Vercingetorix, set up in 1865 in one of the provinces. On each angle of the wall is a flying horse, or a Pegasus, by M. Lequesne. All these figures are of colossal proportions, and are executed in galvanoplastic bronze, with profuse gilding.

While the scaffolding and hoardings were up, the four fronts of the New Opera were a mystery to the Parisians, whose curiosity in matters of decoration and ornamentation is proverbial, and criticism was deemed both unwise and unfair. Now that the four fronts are thrown open to the public every one is at liberty to judge of the general external effect of the structure, especially as it is now unalterable in design.

Placing ourselves between the "refuges" in

San Gallo, Vignola, Maderno, and many others; even that of Raffaelle himself among the number. Such, however, is not the case with regard to Erwin and the cathedral of Strasbourg. It is true that he had able coadjutors and still abler followers; but, after he had once taken the great work in hand, he may be said to have made it his own, and it was, in the main, in strict accordance with his designs alone that all future operations were carried forward. His master-share in the great work may be clearly traced by the characteristics of his peculiar and well-marked treatment of the Gothic style of his epoch; and it may be roundly asserted that by far the greater part of the vast structure bears the impress of the unmistakable signet which has stamped his well-defined individual style. The share of artistic merit and originality due to his predecessors and successors is equally well defined, and a careful estimate of the claims of each leaves, plainly enough, the chief glory to Erwin, and to no other.

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Bishop Conrad, fully appreciating the wonderful excellence and completeness of Erwin's grand design, and perceiving, at the same time, the vast amount of labour that would be required to carry it into effect, felt that more than ordinary efforts must be resorted to for that purpose. Under these convictions, he despatched proclamations to all parts of Europe promising "indulgences" and other ecclesiastical inducements to all who should at once come forward and energetically assist in carrying the magnificent plan of Erwin of Steinbach into execution. From the chronicles of the time we learn that the appeal of the bishop was enthusiastically responded to, and that such great numbers flocked to the work under the influence of the proffered inducements, that the city of Strasbourg exhibited a most extraordinary and unwonted spectacle on the sudden assembling of a vast multitude of artists, artisans, workmen, and unskilled labourers of every description, of both high and low degree, all anxious to commence the vast undertaking. It will be seen by this statement of the chroniclers that the army of volunteers thus suddenly assembled to commence and carry forward the great work was not solely composed of skilled artisans of the various classes required, but also of vast numbers of all classes, anxious to work as common labourers in what was deemed a holy cause; and we are informed that even women and children were among the number of those assembled—each eagerly impatient to aid in the great undertaking according to his strength and capacity, utterly regardless of rank, station, age, or sex.

This multitudinous enthusiasm was, however, soon proved to have its inconveniences as well as advantages, as may be seen by the following graphically recorded incident. When all had been prepared under the directions of Erwin for the laying of the corner stone, and the bishop himself had performed his part in the ceremonial by digging out the first spadeful of earth, several enthusiastic master-masons rushed forward at the same instant to secure the highly coveted honour of digging the second, and the two foremost being equally determined not to give way, hard words ensued, which led to harder blows, and the weapons being heavy iron spades the contest soon terminated fatally for one of the combatants. This untoward event was regarded as a bad omen; and a great discouragement fell upon the assembled multitude; but the bishop having announced his determination to devote nine days of continual prayer to the purification of the spot, and carried his declaration into effect, it was believed that the evil augury was removed, and the work was recommenced with undiminished spirit and determination. The accident was, indeed, turned to good account in the form of a fortuitous stimulant; for a band of priests, who were always present to incite both artist and labourer to the greatest possible amount of exertion, ingeniously compared the event which had just occurred to the story of Hiram, at the building of the temple of Solomon, who, according to the sacred record, was slain by his fellow architects, who were jealous of his superior skill. This kind of encouragement is said to have told with wonderful effect, for the men belonging to the guild of masons were well versed in Scripture reading, and fully appreciated and relished the analogy thus set before them. The story of the building of the Temple of Jerusalem was, indeed, still further utilized after the same fashion, and the high rewards bestowed upon its constructors unctiously dwelt upon, especially those apochryphal ones described in the Mediæval legends which in Roman Catholic countries have so closely associated themselves with the Biblical account of the building of the Temple.

Erwin was aided in his great undertaking by his sons, John and Wynkin, and also by his daughter, Sabine, whose features and figure are said to be reproduced in several of the graceful statues of female saints which enrich the decorative portions of the cathedral, and more especially in the delicately sculptured figures of the "wise virgins" in the niches of the great portal. Several of these are traditionally asserted to be her own work, for it was in the higher kinds of decorative sculpture that Sabine is said to have chiefly excelled. The general style of the extensive works undertaken by Erwin in order to carry the structure rapidly forward on its way towards completion are, naturally, stamped with the general impress of the phase of Gothic art which developed itself during the last quarter of the thirteenth century; but in general richness and infinite delicacy and refinement of detail it exceeds most other examples, and marks a decisive advance towards the more florid development of the fourteenth century, during which, in fact, the greater part of the design was carried into execution.

In this great monument of Gothic art, not only do the lateral portals and those of the principal façade exhibit an excessive richness of design, but the whole external surface of the structure is elaborately enriched with delicate ornamentation in almost equal excess. The feature of detached columns in front of recessed portions of the work, such as windows and niches, which was one of the most charming general characteristics of the more richly decorated works of the period, is more profusely and delicately carried out at Strasbourg than in other great works of the same epoch. Erwin has, indeed, made this feature a very leading one in his system of external ornamentation, insomuch that the vast number of detached columns, delicately slender, and combined with attendant ornamentation, might almost be compared to a profusely embroidered veil cast delicately over the entire face of the building. So delicate, indeed, is this profuse display of detached column-work, that one can scarcely understand how it should have withstood the wear and tear of time and tempest, in a severe climate, at the foot of the Vosges mountains, through a course of 600 years, with a comparatively small amount of injury. Yet this slight and almost detached work has, in fact, stood better, in many places, than the more solid portions of the building, and seem to require less renovation in the course of the careful restorations that have been in progress for several years.

The architectural critic Milizia speaks of the cathedral of Strasbourg as resembling in many respects those of Paris and Rheims, "*e d'un gusto consimile a quello di Rheims e di Parigi;*" but the resemblance is by no means so great as might be inferred from the words of the Italian critic, its far more lofty proportions giving to it a general character very distinct from either of those well-known structures. For instance, the tops of the towers of Notre Dame are scarcely higher than the upper line of the main façade of Strasbourg, before the commencement of the upper part of the tower and steeple; the total height of the Parisian structure being about 202 ft., while the general mass of the main façade of Strasbourg is near 200 ft., and the total height of the building to the top of the steeple is 436 ft.* It is this great elevation which removes it beyond the sphere of comparison with almost every other architectural structure in Europe; and we therefore find it occupying a prominent position in those diagrammatic compositions in which the relative heights of the greatest edifices of the world are estimated, and in which the height of Strasbourg challenges even that of the great pyramids of Egypt. It is, indeed, one of the most remarkable of the gigantic temples which the spirit of Christianity produced through the medium of the earnestness and enthusiasm of the great masonic architects of the Middle Ages. Felibien, in his "*Recueil Historique de la Vie des plus célèbres Architectes*," asserts, in his brief outline of the career of Erwin, that all the thirteenth and fourteenth century work of Strasbourg Cathedral must be attributed to the designs of that great artist, although he did not live to see the whole of his plans carried out. And Felibien is no mean authority, for although an architect of the most rococo school of Louis XIV., at a time when Le Pautre was putting the finishing touches of his *bric-a-brac* fancies to the palace and gardens of Versailles, he had nevertheless a fine capacity for judging liberally, broadly, and critically of the architecture of all styles and ages. He was, in fact, a true cosmopolite in art, and expresses his regret, while speaking of the beauties of Strasbourg Cathedral, that he has not sufficient space at his command "pour faire connoître avec quel art et quelle magnificence on batissait alors en diverses lieux d'Allemagne et en Angleterre;" while he frequently expresses great and genuine admiration of the architectural monuments erected by the Moors, which most of his contemporaries looked upon as neither more nor less than absolutely barbarous.† When the French critic goes on to speak in some detail of Strasbourg, he says, "On ne voit guère d'édifices Gothiques plus grands ni mieux construits," exclaiming, "On ne sçaurait bien connoistre la beauté de cet ouvrage sans en voir au moins le dessin." He then enters

* Felibien states the height of the spire of Strasbourg to be 480 ft.

† Felibien's interesting work was published in 1696, and dedicated to the minister Louvois.

into many interesting particulars which have been made use of by Milizia without acknowledgment,—especially those relating to the relative proportions of contemporary Gothic edifices. Milizia also appropriates the passage of the French biographer in which he states that the architect introduced his own statue among the decorative sculpture of the interior of the cathedral, describing the precise spot where the effigy of Erwin might be seen against the upper part of one of the great pilasters; from which position, on the level of the upper range of gallery-work, he appears in the attitude of taking a general survey of the interior of the building. The intelligent biographer, Felibien des Avaux, who relates to us these interesting facts, was born at Chartres, and it may be that the remarkable cathedral of that city first aroused in him that general love of architecture which not only determined his choice of a profession, but at the same time developed that enthusiastic appreciation of Gothic art in particular which was so unusual in his time, both with architects and their patrons, that many most noble Gothic interiors were entirely encased in work of the fashionable Franco-Italian style of the Louis XIV. epoch; in which Vandalic process corbeilles, canopies, statuettes, and tabernacle work of the most exquisite kind were ruthlessly chopped off close in order to make a smooth and convenient surface for the reception of the fashionable stone or stucco-work of the time, which was destined to form a courtly garment of white and gold, after the manner of the glittering chapel of Versailles.* Perhaps even Felibien himself may have been active in desecrations of this kind, when tempting "jobs" turned up; but however this may be, he was a genuine admirer of the great Gothic cathedrals. After describing the statue of Erwin, he goes on to state that among the more noticeable statues were the three equestrian figures of Clovis, Dagobert, and Werner of Hapsburg, the most illustrious among the successive founders and refounders of the cathedral. Such statues, as the works of Gothic art, are extremely remarkable and interesting; equestrian statues being rarely found of such considerable dimensions. These were, no doubt, subjects upon which Erwin lavished much of his own artistic labour, and were deemed the chief pieces among the sculptures of the great work in hand. It is in unusual features of this kind that the student feels the greatest interest,—comparing them, perhaps, with the equestrian statue of St. Martin above the chief entrance to the church, dedicated to that saint, at Laon, or to the celebrated life-size equestrian statue of Stephen of Hungary, supported by a great projection of corbeille work against a massive group of columns in the cathedral of Bamberg; for, with the more general characteristics of Strasbourg Cathedral ordinary descriptions have already made him familiar. Among the external features, none strike the spectator more forcibly, or produce a more indelible impression upon the imagination, than the well-known exterior staircases, which, running up the angles of the towers, form a kind of perforated hexagonal turrets of the lightest and most attractive aspect, and are a peculiarly Erwinian feature, which, as will be seen, he was so well pleased with that he introduced it in subsequent works. The spire itself is also peculiar in treatment, the lower portion consisting of a series of pinnacles, rising one above another from the central cone, of acuminating stonework, until, within a certain distance of the apex, the cone itself becomes a grand central pinnacle or spire, formed of perforated work of very rich tracery. The general composition of this elaborate spire has been an object of admiration and curiosity ever since its construction, and the names of visitors of all countries are to be seen at the top of the internal staircase, more or less deeply cut in the stone, among which are those of Herder and Goëthe. The final *bouton*, or finial, which crowns this lofty spire can also be reached by external climbing, the only protection being obtained by means of small projecting iron bars, which the adventurer clutches with a feeling that a tight hold is his sole chance of safety; yet many have successfully scaled this giddy eminence, and while there broached a bottle of Alsatian wine to the prosperity of the good city of Strasbourg.

Among other points of excellence that cannot fail to strike a visitor, notwithstanding a previous general knowledge of the main characteristics of the structure, are the three portals of the great western façade, especially the two with the series of nearly life-size figures in the highly decorative niches, representing the "wise and foolish virgins," one of the subjects most favoured by the Gothic sculptors of Germany. In one of the niches devoted to the "foolish virgins" Satan appears in the character of the tempter, holding in his hand the typical apple. The Scriptural symbol of the serpent is most ingeniously blended, in Mediæval fashion, with the human form. As a tempter he presents a very pleasing and attractive front; but on looking to the back of the figure, the spectator perceives that its form is entirely composed of the coils of one or many serpents, the presence of which, it is supposed that his guile enables him to conceal from those on whom he is about to exercise the fascination of the tempter. The nearest of the virgins to this figure, the last among her companions remaining to be tempted, wears a self-satisfied smile as she meets the satanic advances, to the flattering blandishments of which she is evidently about to succumb, and adopt the pomps and vanities of the world which, under the symbol of the apple, are proffered to her. The features of those of her companions, who have already fallen away, are stamped with various degrees of despair and remorse, which the sculptor has expressed with wonderful art. This skilfully-wrought expression of the faces is powerfully supplemented by the apparent action imparted to the arms and hands, which is highly dramatic in character. It is true that the artistic treatment is marked by a certain stiffness inseparable from the naïve realism of Gothic art, but at the same time full of a certain charm of quaint simplicity which equally belongs to it, and which modern art, in its attempts at reviving the forms and treatment of Mediæval sculpture, has signally failed to reproduce. The placid beauty of the "wise virgins" in the opposite niches, forms an exquisite contrast to the remorse-stricken forms of their fallen sisters; the quiescence of their easy positions and the expressions imparted to their features of sweet and confident repose and hope, are of the highest kind of that truly refined art which the sculptor-masons of the thirteenth century displayed in their architectonic sculpture; and in more than one of them it is probable that we may trace the face and figure of Erwin's artist-daughter Sabine.

The central entrance, though perhaps still richer, is not so interesting in its statue-sculpture; and the feature which formerly gave to it a fitting pre-eminence—namely, the superb doors of bronze, celebrated masterpieces of the sculpture of the period—are no longer in existence, having been melted down during the French Revolution, in order that they might be coined into pieces of one and two sous for the use of the republican government.

The interior of Strasbourg Cathedral, even after the most careful study of the various published descriptions, never fails to produce a striking impression on the spectator, on account of its great height, which, from the floor to the centre of the groining of the roof, is said to be 230 ft.; a height so great that the towers of Notre Dame, of Paris, or those of York Minster, might stand within this lofty interior without touching the ceiling. This enormous height has afforded the architect the opportunity of introducing the line of lofty and splendid windows which form such a noble feature above the line of the clearstory, admitting a flood of light and atmosphere to the upper part of the vast interior which produces an unrivalled effect of brilliant lightness; while beneath these spacious and magnificently traceried openings a richly contrasting effect is produced by the smaller line of windows at the back of the double arches of the clearstory. It would be idle to attempt anything like a detailed account of the general ornamentation and decorative sculpture of this well-known and often-described work; but in its profusion of remarkable features each fresh visitor finds something new to dwell upon which has not been especially singled out for criticism or admiration by his predecessors. Among such special *morceaux* the writer of the present notice was especially attracted to the close examination of the exquisitely elaborated stone pulpit, which is perhaps one of the most intricately wrought pieces of delicate tabernacle work in Europe; and, although the treatment of some of the details would appear to suggest a somewhat later period for its execution than the time of Erwin, yet there can be little doubt that the design, in all its main features, and the disposition and proportions of its details, is due to no other, although his design may have been carried into execution, and perhaps modified by some of his successors in the great work.

There is also another feature, and that a peculiarly Gothic one, which has been wrought out with more than usual richness and success in this wonderful interior, namely the corbeille and canopy-work attached to the columns for the reception and display of statuary. This device for varying the ascending lines of lofty columns was certainly a most happy thought of the Gothic architects, and is the more interesting as being entirely absent in classical architecture, in which the moderate height of the columns does not, in fact, admit of its successful introduction. In the great Gothic cathedrals, on the other hand, this device serves at once as a point of agreeable repose to the eye in measuring the enormous height of the columns, and forms at the same time a most graceful and picturesque means of furnishing the edifice with all the convenience for a gallery of sacred sculpture without trenching upon and crowding up the lower portions of the space for the accommodation of the congregation. One of the most remarkably rich examples of such displays of statuary, supported on lofty corbeilles at the mid-height of the towering columns, to which they are made to appear almost necessary adjuncts by the addition of the elaborate canopy, is the series of sculptural figures, of life-size, and in fully-detached relief, which, tier above tier, cluster round a massive group of columns in the south transept, and which, in their own distinct style, form an architectural feature fully as striking as the celebrated spiral series of marble pictures which wind round the wonderful column of Trajan from base to summit. The lower set of figures clustered round that group of columns at Strasbourg consist of the four evangelists, supported on very magnificent corbeilles, the carvings of which represent, with a marvellous addition of intricate ornament, the well-known symbols of the four evangelists,—the angel, the bull, the lion, and the eagle. Above the figures are exquisitely-enriched canopies, surmounting which are four figures of angels, of remarkably fine execution, in attitudes of flying downwards, and in the act of communicating the inspired records to the authors of the Gospels. Above these is another tier of figures, the chief of which is the Saviour, descending from heaven, guarded by other angels. Such are a few of the more remarkable features of Erwin's great work, which, long before its completion, was awarded the first rank among the seven wonders of Germany.

* The writer has recently examined several interiors so treated, of which the cathedral at Wurzburg is perhaps the most notable example.

THE NEW OPERA HOUSE, PARIS.

As all municipal buildings have almost stopped work, the New Opera remains in almost the same state that it was in a few months ago, except the principal front, which, a few days before the 15th of August, was denuded of its box-screens, sheltering the four groups of statues at the entrances. These groups, one on each side of the doorways, are as follows: Music (by M. Guillaume); Lyric Prose (M. Jouffroy); Dance (M. Carpeaux); Lyric Tragedy (M. Perraud). Between these groups are four allegorical statues: Idyll, Cantata, Fable, and Elegy, the works of MM. Aicelin, Chapus, Dubois and Vatrinelle, and Falquières.

On the summit of the building, active operations are being undertaken to place the crowning statues, &c. At the angles of the façade, Lyric Poetry and the Muses occupy one; on the other are Lyric Poetry and the *Renowned*. These are due to M. Gumery. The colossal statue of Apollo, lyre in hand, has already been placed on the pediment of the great stage wall. It is by M. Aimé Millet, the artist to whom France owes the grand statue of Vercingetorix, set up in 1865 in one of the provinces. On each angle of the wall is a flying horse, or a Pegasus, by M. Lequesne. All these figures are of colossal proportions, and are executed in galvanoplastic bronze, with profuse gilding.

While the scaffolding and hoardings were up, the four fronts of the New Opera were a mystery to the Parisians, whose curiosity in matters of decoration and ornamentation is proverbial, and criticism was deemed both unwise and unfair. Now that the four fronts are thrown open to the public every one is at liberty to judge of the general external effect of the structure, especially as it is now unalterable in design.

Placing ourselves between the "refuges" in

a line with the north side of the Boulevart des Capucines, we have a good view of the front elevation as far as the cast cornice-work which is the starting-line of the attic story for the rest of the building, but we see no more of the great pile. Passing to the eastern elevation, we find a totally different façade and of a style hard to be reconciled with that of the front elevation. At the rear the elevation is not devoid of boldness, differing, though it does, from any of the others. The same remarks apply to the western front. It seems that the aim of the architect has been to group together all the known styles of architecture, and to make as much use of them as he can, by disposing them conventionally.

By taking up a position, however, in the Avenue Napoleon (the new street leading from the Opera to the Palais Royal), there appears at one a certain harmony of outline and details in the structure seen in perspective. It is lawful for an architect to make any two opposite façades, or building, of totally different aspect and style; but the adjacent fronts should harmonise so as to give no shock to the eye when seen in perspective. This M. Garnier seems to have understood; and the perspective lines of two adjacent sides of the quadrangular building are so conceived that the structure thus viewed seems to possess all the desired harmony, amplitude, and elegance. For instance, returning to the Avenue Napoleon, all the timidity of the low front elevation disappears; all the building rises up in its grandeur; first the cupola of the *salle*, then the terminal pediment of the stage; and the mascarons of the front correspond with the commencement of the gables of the roof of the building, above the attics.

Some cry has justly arisen against the "Dance" of M. Carpeaux on the principal façade, in which group he has given us the model, *in puris naturalibus*, of a drunken Bacchante, the allures and attitude of which are disgracefully impure and immoral. An official journal says that there is some rumour it will be removed,—1,600*l.* thrown away. Carpeaux's model was approved of by the Government, so that they are in fault for not having added a little drapery in time.

As to the interior decorations of the new Paris Opera-house, it is too early to criticise the work.

TENTERDEN, KENT.

A READER asks us to tell him something about "the stupid story that calls Tenterden Tower the cause of the Godwin Sands." It is a very old story, not quite so "stupid" as our over-clever correspondent seems to think, and we might refer him to the guide-books for an answer. However, in a dozen words, the tradition is that the abbot of St. Augustine's, Canterbury, employed, in building Tenterden Tower, stone that had been provided to strengthen the sea-wall of land belonging to Earl Godwin. The wall failing in consequence during a great storm, the land was submerged, and became the perilous sands of which we are speaking. The story was first told, so far as we know, by the witty and unfortunate Sir Thomas More, the author of "Utopia" and friend of Erasmus, and though probably a fable, is anything but "stupid."

"What great events from trifling causes flow,"—

trifling, indeed, if we could really get back to them and trace the connexion of events. A word casually uttered has set its hearer on a track that has led to a discovery of immense importance; and was there not once a great war because of the breaking of a brace-button that disconcerted an envoy, and prevented the completion of his speech? For want of a single nail in his horse's shoe, a man was ruined: we all know the story. And who shall say how the ruin of one man may affect the course of events? Sir Thomas More's statement, if not correct itself, includes a great and useful truth. If the building of the tower of Tenterden Church was not the cause of the Godwin sands, it might have been.

It is a fine tower, bold and lofty, that of Tenterden, Perpendicular in style and good in proportions. The church itself is partly of the thirteenth century, partly of the fourteenth and fifteenth. The nave has a panelled ceiling, and the tower arch is open, so as to show the west window. This was filled not long ago by the late Mr. William Curteis Whelan, of Heronden Hall, with a costly memorial in stained glass, by Lavers & Barraud, of his father and mother, the figures in it typifying their qualities. By the care of Mrs. Whelan, too, a window has been set up at the east end of the church, in memory of the late vicar.

Heronden Hall is a handsome mansion, good serviceable modern Gothic in style, designed by the late Mr. Donthorne, but recently much enlarged, the original architect sacrificing too much to a lofty open-roofed hall, certainly a striking feature. The park has in it a noble oak and the largest ash-tree in the county. No one supposed when the owner of Heronden set up the window to his parents that he was soon to follow them; but so, under the dispensation of Providence, it has been, and the Hall is now to be let for a time until recollections soften. The nearest station for London, by the South-Eastern line, is Headcorn.

Biddenden, on the way from this station to Tenterden, has a church ranging from the thirteenth to the fifteenth century in date. At Standen there is a good sixteenth-century timber house; and at Rolvenden a Perpendicular church worth looking at. These endings in "den" are noticeable. Kemble, in his "Saxons in England," gives some information on the point, which is quoted by Murray. The "dens," part of the Saxon Mark, or settlement, denoted pasture, usually for swine, and were within the uncleared forest which surrounded the settled habitations. There was a Den Court, he says, for this part of Kent, which, up to comparatively recent times, had jurisdiction over forty-four Dens, for the most part still traceable.

SOUTH EASTERN RAILWAY MANAGEMENT,—OR OTHERWISE.

THE following communication has been addressed to the directors of the South-Eastern Railway:—

"Last Saturday morning, at 9.28, I took a first-class return ticket at Charing-cross station for Headcorn. My servant was with me to carry portmanteau to the carriage and to take back replies to a bundle of letters brought to me at the station. The officer at the gate, with a certain amount of insolence, refused, however, to let him pass with me to the carriage, although I explained the serious importance of having him by me to the last moment. The man admitted that if my servant, whose capacity was evident, had been in livery he could not have prevented him from passing through. The course pursued by your officer on this occasion caused a most serious inconvenience, and I must take the liberty of saying that, if he acted in accordance with orders, such orders are not calculated to serve the interests of passengers or company.

On the following evening, the 8.13 train, when it stopped at Headcorn, included but one first-class wagon, which was full, and I was compelled to return to London in a second-class carriage, having paid for first, amongst, as it happened, mewling infants and reeking men. At London Bridge, at Cannon-street, and at Waterloo Junction, we loitered to take up and set down passengers, and the result of this and previous proceedings was that we arrived at Charing-cross at 10·40 instead of 9·55 as advertised, or 45 minutes after time; and as my coachman had thought it necessary to wait only 40 minutes after the hour for which he had been ordered, I was left to the chance of a cab, with the consequent expenditure.

Any one of these incidents would reflect on the management of a railway: and, having been subjected to the series consecutively, I feel bound to complain gravely as well for the sake of the public as of myself."

THE EMPEROR-ARCHITECT HADRIAN.*

THE antiquaries who have espoused the cause of Hadrian *v.* Severus, as being the author of the great Roman wall in England, will be glad to hear that a French biographer of the imperial architect commences an enumeration of his works with mention of this great barrier. The writer in question, M. Charles Lucas, after stating that Hadrian was born in Rome, January, A.D. 76, and succeeded Trajan in 117, and enjoyed the supreme power for twenty-one years, gives a few of the opinions of ancient authors concerning his accomplishments. He was pronounced poet, painter, and architect. It is, however, only with this last capacity that M. Lucas deals. Without quoting any authority, or throwing any new weight into the scale, he merely states as a fact, that after the year 120, to the end that he might preserve the Roman colonies in Great Britain from the incursions of the Picts and Scots, Hadrian constructed an immense wall to the south of the Cheviot mountains, which strong stone line M. Lucas erroneously believes to be the boundary between the two countries at the present day. Continuing the account, Hadrian built a temple in honour of Plotine, the wife of Trajan, at Nimes. At Tarracone, he rebuilt the Temple of Augustus. He embellished Carthage, and added to it a new quarter which took his name. Between the years 123 and 125, during his first stay in Asia Minor, he reconstructed in great measure the city of Cyzique, which the Emperors Augustus and Tiberius had also attempted to improve. At Ephesus, he reared a temple to Roman Fortune; at Antioch, where he first heard of his elevation to the imperial power, he built a public bath, an aqueduct, and a temple, dedicated to Nymphs, in which water sources formed fine fountains. At Athens he built a new city, divided from the old one by an arch, which bore two inscriptions; the one looking upon the old city, of Minerva, reading, "Here is the Athens of Theseus;" and that facing the new buildings notifying "Here is the Athens of Hadrian." Among the edifices he erected here were two temples, whose magnificence we can picture from the account of Pausanias, who says that the porticoes were formed of 120 columns of Phrygian marble, that the walls were of the same marble, and the halls were decorated with sculpture, paintings, gold, and alabaster. Moreover, he restored the temple of Jupiter Olympus, in recognition of which task the Athenians placed a colossal statue of him near it. He made more than one visit to Athens, for in the second visit he consecrated some of the edifices he commenced on the first. At Corinth, too, in his day were built baths and an aqueduct; the tomb of Epaminondas was embellished by an inscription composed by the emperor; at Matinée was rebuilt a temple in honour of *Neptune Hippius*; at Hyampolis a portico which bore his name; at Abès he rebuilt the great temple of Apollo, and at Némée, the hippodrome. Visiting Egypt he built a monument to Pompey the Great. He ascended the Nile as far as Thebes, and visited the statue of Memnon with his wife, their stopping-places being handed down to posterity in inscriptions. Here he lost his favourite Antinous, to whose memory he built a city he called Antinopolis. On his return to Rome, A.D. 135, he only quitted it occasionally to reside in his celebrated villa. In the Eternal City he founded the Athenæum, restored the basilica of Neptune, the forum of Augustus, built a circus, threw a bridge over the Tiber, and placed on it the magnificent mausoleum intended for his remains. M. Lucas has not taken the trouble to collect evidences of his numerous works in other parts of Italy, although he states they exist in the form of inscriptions on many of great importance.

The villa built by Hadrian at Tivoli is described at some length, with references to the works of Ligorio, 1560; Antoine del Re, 1611; Kircher, 1671; Contini, 1634; Piranesi, 1781; besides the more modern authorities, Bardi, Nibby, and Canina; but a French account of it by M. Daumet is specially cited as exhaustive in an artistic point of view. This villa, or assemblage of buildings, grouping together all that the emperor had seen and wished to reproduce in the course of his travels in Greece and Egypt, it will be remembered, did not long survive its author intact, having been dismantled by Caracalla for the enrichment of his own thermes, and finally devastated by Totila, in his siege of Tivoli. About ten miles in circuit, containing a Lyceum, an academy, a Paecile, a palace, a Serapeon of Canopus, Greek and Latin libraries, barracks for the guards, several theatres, numerous temples, fountains, a vale of Tempe, besides other landscape features in imitation of celebrated scenes, this remarkable villa provided the columns and other marbles for all the churches, palaces, and principal habitations in the neighbourhood; and its ruins have furnished antiquities for every museum of note in Europe. M. Lucas not inaptly couples it with mention of the South Kensington Museum and Sydenham (the credit of which last, with the usual French difficulty the matter of English titles he duly places to the account of "Sir Paxton"), both reared within the last fifteen years for the purpose of gathering together, in like manner, though for a different purpose, specimens of the architecture and arts of the known world.

* L'Empereur-Architecte Adrien (Publius Ælius Adrianus). Étude Antique par Charles Lucas, architecte. Paris: Ernest Thorin. 1869.

LONG SPAN BRIDGES.

Professor de Volson Woods gives the following tables of bridges having long spans, in the "Journal of the Franklin Institute":—

TRUSSED BRIDGES.

NAME OF BRIDGE.	Total length in feet.	No. of Spans.	Longest Span.	REMARKS.
Schaffhausen, Switzerland	365	2	193	Weisbach Mech., Vol. II., p. 283.
Trenton, N.J.	880	5	200	Wooden arch trussed. Haupt on Bridge Construction, p. 242.
Columbia, Pennsylvania	5,280	29	200	Burr's—destroyed during rebel invasion, 1863. Mahan, p. 240.
Newark Dyke, Eng.	...	...	240½	Longest span of Warren's Girder. Jour. Frank. Inst., Vol. XXVI., 3d Series, p. 156.
Essex, Mass.	250	1	250	Mahan, Civ. Eng., p. 238.
Chepstow, Eng.	606	4	306	Queen Post—Theory of Bridges—Weak.
Noget, E. Prussia	3741	2	321	Jour. Frank. Inst., Vol. XXXIX., 3d Ser., p. 230.
Upper Schuylkill	5,201	1	340½	Mahan, p. 237.
Louisville Bridge, over Ohio River	...	25	370	Fink's Truss—Report of Company.
Wettingen, Germany	390	1	390	Erected in 1778. Longest span of wooden truss on record. Weisbach Mech., Vol. ii., p. 83.
Dirschau, Prussia	2,383½	6	397½	Iron Lattice. Jour. Frank. Inst., Vol. XXXIX., 3d Series, p. 230.
Kuilmburg, Holland	...	...	515	Longest span trussed bridge. Official Rep., 1866.
Derry, designed by Claus (never built)	...	1	600	Proposed wooden structure. Wies. Mech., Vol. II., p. 84.

TUBULAR BRIDGES.

NAME OF BRIDGE.	Total length in feet.	No. of Spans.	Longest Span.	REMARKS.
Conway, Eng.	...	1	400	Civ. Eng. Jour., 1848.
Britannia, Eng.	1,513	4	460	Tubular Bridges by Dempsey. Traité de la Construction des Ponts Métalliques, Pl. X.
Victoria, at Montreal, Canada	10,284	25	330	Hunt's Merch. Mag., Vol. XXXI., p. 504; 24 spans are each 242 feet.

ARCHED BRIDGES.

NAME OF BRIDGE.	Total length in feet.	No. of Spans.	Longest Span.	REMARKS.
Neuilly (over Seine)	more than 640	5	128	Mahan, p. 225.
Teff, South Wales	...	1	140	Failed by rising of the crown. Woodbury on the arch, p. 432.
London Bridge	784	5	152	Woodbury, p. 432—for railroad purposes.
Ries, Ayr	...	...	180	Jour. Frank. Inst, Vol. XXXIX., p. 231.
Chester or Grosvenor	...	...	200	Mahan, p. 228.
Great Washington Aqueduct	...	...	200	Sc. Am. 1860, p. 86. Cast iron, by Rennie.
Southwark	...	...	250	Smiles's Lives of Engineers, Vol. II., p. 188.
Trizzo Adda	251	1	251	Longest stone arch on record. Treatise on Bridges, Weale, Vol. I., p. 48.
St. Louis Bridge	1,509	3	515	Not yet built. The arch to be of steel. Rep. by the Co 1858.
Proposed Bridge over the Thames, by Telford	...	1	600	To be made of iron. Weisbach, Vol. II., p. 86.

SUSPENSION BRIDGES.

NAME OF BRIDGE.	Total length in feet.	No. of Spans.	Longest Span.	REMARKS.
Niagara Carriage Bridge	...	1	1,264	Sc. Am. Vol. XX., p. 218. This bridge is about a mile below Niagara Falls.
Cornwall (proposed to be built across the Hudson River, 42 miles above N. Y. City	2,499	1	1,600	Jour. Frank. Inst., Vol. LVII., p. 165.

	When Built.	Span.	
Douro, at Oporto	1842	558	Sup. to Weale's Bridges, p. 144.
Menai, Eng.	1825	580	Chain cable. Mahan's Civ. Eng., p. 255.
St. John's, N.B.	1852	622	Sc. Am. June 19th, 1852.
Nashville, over Cumberland	1850	658	Destroyed by Rebel Gen. Floyd, Feb., 1862. Sc. Am. Mar. 30th, 1850.
Pesth, over Danube	1849	670	Total length, 1250. Jour. Frank. Inst., Vol. XVII., 3rd Series, p. 300.
Niagara Railroad Bridge	1854	822	Jour. Frank. Inst.
Fribourg, Switzerland	1834	870	Ibid., Vol. XXIII., 2nd Series, p. 141.
Lewiston (7 miles), below Niagara Falls	1856	1,043	Sc. Am. June 1, 1861. Blown down, Feb., 1864.
Lexington and Danville Railroad Bridge	1856	1,220	Jour. Frank. Inst., Vol. XXXIX., 3rd Series, p. 230.
East River Bridge, N.Y. City	...	1,600	Proposed, Jour. Frank. Inst., Vol. LXXXIV., p. 243.

THE STATE AND PROGRESS OF MECHANICAL SCIENCE.

The hearty vote of thanks which, on the motion of Mr. Ramsbottom, of Crewe, was so readily awarded to Sir William Armstrong, for "the valuable and interesting address" delivered by that gentleman, as President of the Institution of Mechanical Engineers, at their recent annual meeting at Newcastle, is entitled to a sympathetic echo in our columns.

In portions of his address Sir William went over ground familiar to the readers of the *Builder*. It is a matter of just satisfaction to a public writer to find views which he has been long endeavouring to bring before the world so fully adopted, and so eloquently enforced, as in the present instance, by the President of the Mechanical Engineers.

The President referred, *apropos* of the use of steam, to that great problem of hydraulic engineering to which we have repeatedly called the attention of our readers (*Builder*, October 28th, 1867, *et passim*), the great enigma of which M. de Lesseps is the sphynx.

The direct application of steam power to the excavation of the Suez Canal is indeed one of the most remarkable of the recent features of engineering achievements. Sir William observes that in quantity of material moved, the Suez Canal is far more vast than the Great Pyramid. Quantity, however, is a relative term. If we compare the actual amount of labour involved in the quarrying, the transport, the working, and the setting of the three millions and a half of cubic yards of solid masonry which the Great Pyramid approximately contains, with that required for the scooping out of the ninety-six millions of cubic yards estimated as the material to be removed for the sinking of the canal, the balance will incline heavily in favour of the former, notwithstanding the immense service rendered by steam to the latter work. But there is yet another feature not hinted at by the President. The work of Souphis has endured for some fifty-four centuries, according to the best modern calculations of dates. Having suffered the utmost violence that the caprice or the curiosity of man could inflict, it is as likely to endure for a second or for a third period of equal length, as the Nile is to continue to run through Egypt. Whether all the ingenious toil and unsparing cost of the enterprising French engineer will ever succeed in making a channel 28 ft. deep from sea to sea, and how long, if once made, this channel will last, are questions as yet entirely unanswered. The last attempt to elicit an authoritative statement, made in the House of Commons on the 2nd of August, entirely failed, as the Under-Secretary of State replied that the Foreign Office was not in the possession of any official information on the subject. In fact, Mr. Otway seemed to have no more recent guide than a report made, in the columns of the *Times* newspaper, by Mr. Fowler nearly six months ago, to which he added the statement from "other sources," that the intended depth of 26 ft. was reduced to 18 ft. As to the progress of the great experiment of the filling the basin of the Bitter Lakes, not one word of assuring information seems to have reached this country, the testimony of the last traveller (a man well fitted for forming an opinion) being in the last degree unfavourable.

From the Suez Canal, Sir William Armstrong passed to a subject very fully entered into in our columns last July, and introduced to public attention in the *Builder* of 17th August, 1867, as well as previously, that of the coal supply of the future. The additional information to be gathered from the address referred to the use of pneumatic coal-cutting engines in the Hetton Colliery, by which not only is human labour to a great extent superseded, but a supply of air, at a temperature of 7 degrees below freezing point, escapes into the mine, the influence of the expanding air that is discharged by each machine being sufficient to lower the temperature of the circulating atmosphere by one degree. The combination of pure ventilation with a supply of cool air affords a means of penetrating to greater depths than have been hitherto reached.

From the contemplation of these various and distinct portions of the field of mechanical engineering, the address passed on to that in which the President may be expected to be more especially at home,—the condition of artillery, and the present state of the ever open question of the relative strength of our means of attack and of defence. Here again we meet a subject not unfamiliar to our readers. (*See Builder* of February 3, 1866; July 27, 1867; and May 10, 1868.) The remarks upon the function of heat in increasing the projectile force of powder were such as to demand attention. By the discharge of fifty rounds in succession, a field-piece is made so hot that it cannot be touched. The actual flame contact which produces this effect is limited to the third of a second, or the 150th part of a second for each discharge. The calorific effect of the thin film of heated matter deposited in the bore at each discharge, may be set against the intermediate loss of heat by radiation. In small guns the area of absorbing surface surrounding the charge is proportionally greater than in large guns. The greater heat attained in the latter both adds directly to the explosive force of the powder, by expanding the gas, and acts indirectly by accelerating the inflammation of the powder. When the additional resistance to the expulsion of the projectile which is caused by the rifling of the barrel is taken into account, it is estimated that the pressure actually reached in guns of a large size when fired with English service powder, is not less than seventy thousand pounds on the square inch. It would be interesting to have some more distinct indication of the data which lead to so prodigious an estimate.

To resist this terrible bursting pressure it becomes of the last importance to understand the most appropriate material, and the best method of manufacture, for a heavy gun. Krupp and Whitworth advocate the use of steel; but it is rather the hoped-for steel of the future, than any as yet produced by human hands, to which they can look with any confidence. The American Rodman gun is of cast-iron, the inside being cooled first, and the external portion of the metal being allowed to shrink upon the hardened interior; the object being to keep the metal in the interior in a state of compression, and that on the exterior in a state of tension. Sir William adheres to his opinion that coils of

welded iron, surrounding a steel tube, form the best guns. The main reason for the preference of iron is the fact, or at least the positive opinion, that steel, while possessing much greater tensile strength than wrought-iron, is less adapted to resist concussive strains.

The last point on which the address enlarged was one with which our readers are not unfamiliar. It relates to the mounting of guns, both for land and for naval service. The views which we have taken occasion to express as to the mode in which the fortifications of the future will be modified in consequence of the important invention of Capt. Moncrief were fully endorsed by Sir William Armstrong. Still more interesting was the accordance which he expressed with our opinion as to naval artillery. A mere floating gun-carriage, as small as possible, in order to carry a heavy gun, and the machinery requisite for propulsion, is that which we have indicated as the great *desideratum* of naval construction. Sir William not only agrees with this opinion, as theoretical, but illustrates it by the experience of the proving-barge of the Elswick Works, which is a mere floating gun-carriage. This proving-barge was the origin of the idea of Mr. Rendell's now well-known gun-boat *Staunch*, which is provided with steam power for propelling a twin screw, and for working a 12-ton gun. This vessel is so small as to be a very difficult mark to hit, and is, at the same time, very inexpensive. Guns of the largest size may be mounted in vessels similar to the *Staunch*, without increasing their tonnage in more than a proportionate degree.

We feel quite assured that our readers will share our own satisfaction at the reproduction, in an address which authoritatively sums up the recent progress of mechanical engineering, of so much on which we have insisted within the last three or four years. When we use the term reproduction we refer, of course, only to that community of results arrived at by different thinkers, starting from different stand-points, and advancing by different routes, which is one of the happiest triumphs of science. The lover of truth for its own sake will rather prefer that views which he advocates should be independently arrived at, than that they should be adopted on his own authority. The balance of probability inclines far more in favour of their exactitude in the former than in the latter case.

FROM PARIS.

A report on the financial situation of the hospitals and asylums (*hospices*) of the French empire has just been issued by the Inspectors General of the establishments of *bienfaisance*.

On the 1st of January, 1869, there existed 1,557 hospitals and hospices, under the charge of 1,382 administrative commissions. The towns of Nancy, Rennes, and Saint-Omer have 4 establishments; Bordeaux, Valenciennes, 5; Lyons, 7; Paris, 32. Before 1790 there were 1,224 hospitals and hospices; 16 under the first empire; 53 under the restoration; 71 under Louis-Philippe; 11 under the republic; 172 under Napoleon III.; thus bringing up the number to 1,557. The number of beds available in 1847,—viz., 126,142,—is now raised to 141,576; difference, 434. The towns which have the greatest number of beds in hospitals and hospices are as follow:—Paris, 18,785; Lyons, 4,176; Nantes, 2,716; and Lille, 2,188.

This document touches upon a question of importance: it is this, examples of which are daily brought before the public: the difficulties thrown in the way of the free admission of the indigent living in rural districts into hospitals; and, worse again, the insufficiency of out-door attendance on the sick at their own homes.

On the 18th inst., the works for constructing two new groups of public schools on the vast site left free by the demolition of the Grand Hospice des Petits-Ménages, were let in contract. This old building was situated at the angle of the Rues de Sèvres and de la Chaise, and was founded by Henri II. on the site of the ancient leper hospital called Maladrerie Saint-Germain, demolished by order of Parliament in 1544, and transferred without the precincts of Paris. With the exception of the *préaux* and shady trees nothing remains of the Hospice des Petits-Ménages now transferred to the new municipal building at Issy. There a certain number of aged married persons, one above sixty and the other not less than seventy years old, are received. In consideration of a certain sum once paid, the aged couples find there a comfortable repose for the rest of their lives.

During the excavations for a new sewer on the site of the above hospice a great number of human bones were discovered, among which were fifteen skulls. These remains were so phosphorescent that they spread terror among the men.

At the Église Saint-Vincent de Paul a new chapel dedicated to the Virgin is being constructed, at the end of the nave, behind the grand altar. M. de Niewerkerke, superintendent of fine arts, has presented to the curé of St. Vincent de Paul, at his request, the statue of the Virgin, executed by M. Carrier Belleuse, for which he gained the grand medal of honour at the Salon of 1867.

The ten marble busts of the crowned heads who have visited the Hôtel de Ville during the last ten or twelve years have been placed on marble plinths of coloured marble. They are in the gallery] leading from the Salle du Trone to the grand apartments of the prefect, behind the Salon du Zodiaque, the splendid woodwork of which has been recently restored to its primitive grandeur. The busts are as follow:—Queen Victoria, Prince Albert, the Queen of Portugal, the Emperor François Joseph of Austria, the Emperor of Russia, the Sultan, Victor-Emmanuel, the King of Portugal, the King of Prussia, and the King of Bavaria.

The official statistical return of the number of persons who came to Paris to see the Exhibition of 1867 has just been published. It appears that the total number was only 582,205 persons, of whom 200,347 were strangers. Among the latter were 59,367 British, 48,865 Germans, 146 Oceanians, 27,368 Belgians, 33 Georgians, 4,289 clergymen, 4,779 persons of title, 50,335 independent proprietors, 320 journalists, 115 post-masters, 222 ship-owners, 501 men of letters, 23 rabbis, 4 Cochin-Chinese, and 19,212 photographers! How was this found out?

Two new Jewish synagogues are being constructed in Paris, one in the Rue de la Victoire, with a front on the Rue de la Chausée d'Antin, very vast and elevated. The second is being built in the Rue des Tournelles in the Marais, and is to be as important a building as the first; its site is a portion of that of the memorable palace of Tournelles which belonged in 1390 to the Chancellor d'Orgemont; there Leon de Lusignan, king of Armenia, lived and spent the last days of his existence in 1393. During the British occupation it was the residence of the Duke of Bedford, regent during the minority of Henry VI., about 1422. Bedford so increased and ornamented the Tournelles Palace, that, as history informs us, Charles VII., having been reinstated in the possession of Paris, preferred it for a residence to the Hôtel Saint-Paul. It was in front of the spot where the new synagogue is being built that Henri II., king of France, was mortally wounded in a tournay by the Count de Montgomery. The last vestiges of the Tournelles Palace were cleared away by order of Henri IV., to construct the quarter of the Place Royale.

In front of la Petite-Villette, and the park of the Buttes Chaumont, the new iron bridge, of very bold design, by which the Rue de Crimée crosses the Chemin de Fer de Ceinture, has been opened for traffic. Under it, in deep cutting, pass the Chemin de Ceinture and that leading to the great cattle market of La Villette, abattoirs, &c. This bridge is composed of several sections, one of which is in the line of the Rue de Crimée: another section unites the two portions of the Boulevard de Mexico. As was the case with the Pont de l'Avenue de Clichy, under which pass all the lines of the Ouest, the bridge carrying the Rue de Crimée was constructed without for a moment interrupting the traffic of the Chemin de Fer de Ceinture.

The new Clichy bridge over the Seine at Asnières is now open to the public; it is of cast-iron, of good design, and consists of three arches spanning the three branches of the Seine, divided by islands at that spot.

Monument at Rome Commemorative of the Coming Council.—The design submitted to the Pope by his architect, Count Vespignani, for the monument commemorative of the Council, has been approved of. This will consist simply of a column of African marble from the Emporium, raised on an hexagonal base, which will be enriched, on five of its faces, with bas-reliefs, representing five parts of the world, while the sixth face will bear the arms of Pius IX, and the date of the opening and close of the Council. The column will be surmounted by a statue of Pius IX. pronouncing the benediction *urbi et orbi*.

THE RADCLIFFE INFIRMARY CHAPEL, OXFORD.

The Chapel of the Radcliffe Infirmary at Oxford, Mr. Blomfield, architect, has just received an interesting addition to its internal decoration, in the shape of four remarkable pictures, done by Russian monks. During a tour in Russia, in 1867, the founder of the chapel, according to the local *Journal*, visited the celebrated Monastery of Troitzka, or Holy Trinity, about forty miles from Moscow, in the midst of a wild forest. Its massive walls extend 4,500 ft. in length, are from 30 ft. to 40 ft. high, and 20 ft. thick. The building is flanked by eight towers, and forms a fortress of great strength, which has triumphantly withstood siege and assault. It contains a cathedral, ten churches, palace, university, convent, schools of art and industry, and all the requisite accommodations for its thousands of inmates. It is replete with objects of interest, and there are shrines of solid gold and silver, adorned with precious stones, frescoes, carvings, and pictures. The monks have a school of painting, from which are supplied all the pictures and decorative work for the Eastern Church in Russia. About sixty monks are constantly engaged, under the chief direction of the Monk Symeone, on the various pictures in progress, and there is besides a class entirely devoted to miniatures, which are exquisitely executed on mother of pearl, and for beauty of drawing and delicacy of colouring equal any we have in this country. There are three large apartments occupied by the artist monks and their pupils. In the first, are the novices who are instructed in drawing; in the second, the younger monks who have made some advance are initiated into the mysteries of colour; and in the third are the elder monks, proficients in their art. It was here that the four pictures which have just been placed in St. Luke's were produced. They consist of full-length figures of the Evangelists on panel, about 4 ft. 4 in. by 2 ft. They are painted, says our authority, with all the delicacy of miniatures on a golden ground, richly chased and adorned with an exquisite border, the rich colours sparingly introduced into which combine and harmonise charmingly in the general effect.

THE SPIRIT-LEVEL.

Its Invention.—He who first filled a glass bottle with a liquid, leaving a small quantity of air therein to form a bubble, then corked the bottle and laid it flat on one side, with the bubble floating against the upper part, was the unconscious inventor of the spirit-level, which is a very simple instrument in appearance, but of the utmost value, when properly made, to the astronomer, the engineer, and the builder; for when the bottle is placed horizontally, the bubble always mounts to, and rests at, its most elevated point; and the tangent to that point, when the middle or apex-point of the bubble coincides therewith, is a horizontal line; that is, a line at right angles, or perpendicular to the direction of gravity or the plumb-line passing through that point.

This was first perceived and applied, so far as is known, in France in 1666, by Melchisédec Thévenot, who was a great amateur of science and a writer of books of voyages and travels. In this respect he enriched the literature of France as much as Hakluyt enriched that of England half a century earlier. It was at Thévenot's house that the learned men who founded the Academy of Sciences of Paris used to assemble; and it was at one of their meetings that he propounded the spirit-level.

A description of the instrument, accompanied with figures, was first published in the *Journal des Savants*, Paris, November 15th, 1666, under this title:—"Machine nouvelle pour la conduite des eaux, pour les bâtiments, pour la navigation, et pour la plupart des autres arts." The instrument is there called an *air-level*; and is described as a glass tube, hermetically sealed at both ends, containing spirits of wine, which do not freeze, and a small quantity of air forming a bubble. It is stated that the instrument is capable of giving, with much exactness, the direction of the horizon, the perpendicular to the horizon, and vertical angles; and that it is easier to make, more convenient to use, and indicates a level line more readily and accurately than any other instrument. One figure represents the tube charged with liquid, and an air-bubble; a second shows it fitted, under the centre part, with a spindle dropping into a socket fixed on a staff so

as to turn in any direction, and with sights on the ends for levelling to long distances; a third represents it fixed to a square, and a fourth to a short flat bar of wood, as levels for workmen; and a fifth shows it fixed to a quadrant for navigation.

In this first publication the inventor is not named. But in a small work, called "Recueil des Voyages de M. Thévenot," Paris, 1681, there is a description of the instrument by Thévenot,* preceded by a statement that he invented it fifteen years before that time; and that he then gave a description of it to the public. This agrees with the description in the *Journal des Savants* referred to above, which no doubt was written by Thèvenot himself. He also states that soon after its invention an account of it was sent to the Royal Society of London. The celebrated Dr. Hooke was then a constant attendant at the meetings of this body. By this means he became acquainted with it; and, seeing that it would be of the greatest advantage to astronomy, to navigation, to engineering, and to building, he had some excellent tubes prepared, and applied them to various instruments; and he subsequently produced the spherical spirit-level. From this circumstance the invention of the spirit-level, now in common use, has been ascribed to Hooke, but it is undoubtedly due to Thévenot. Much merit is due, however, to Hooke for aiding to perfect it, and to apply it to science. He was the best practical mechanician of his time, as is evidenced by his numerous valuable inventions. He, as well as Wren, whose name is displayed in the most prominent of red-letters on the fame-roll of British architects, were contemporary with Newton; and both Hooke and Wren were within an ace of seeing and propounding the principle of universal gravitation at the moment when the great intellect of Newton had grasped and mastered it,—dispelling for ever the mist that had obscured it.

As, however, the instrument was new, and there were difficulties in constructing it with precision, nearly a century elapsed before those difficulties were removed, and it obtained the preference it merited over the water-levels and plumb-levels then in use, as well as over those that were invented during the interval, most of which are now almost forgotten. It was first practically employed in this country in 1756 by Smeaton for levelling the foundation and courses of stones of the noble lighthouse which he designed and erected on the Eddystone. Thévenot's simple glass tube is now applied to nearly all the instruments used in levelling, and is *the* level *par excellence*.

Its Construction.—The spirit-level, as ordinarily constructed, consists of a short cylindrical glass tube, whose interior surface is, or should be, ground to a slight regular curvature lengthways, and then polished. The curvature, which is much exaggerated in the figure, is almost imperceptible in the tube, the radius being from 300 ft. to 600 ft. The tube is nearly filled with a very limpid liquid, leaving a small space occupied by an air-bubble. The open ends are then hermetically sealed by melting the glass around them with the blow-pipe.

Alcohol or sulphuric ether, whose specific gravities are respectively ·792 and ·715, water being 1·000, are preferred for charging the tube, because these liquids are much lighter, possess the property of fluidity in a higher degree, and are more sensitive than any others. Moreover, intense frost does not affect their fluidity—no observed degree of natural or artificial cold having ever frozen them; and they also have the property of wetting the glass more readily and completely than other liquids, owing to the greater capillary affinity subsisting between them and the glass.

If the tube's curvature were the same as the earth's curvature, the upper line or surface of the liquid would be truly level, and therefore no part of it would have a tendency to fall, or seek a lower position; nor would the bubble, which is considerably lighter than the liquid, have a tendency to rise or seek a higher one, but would remain uninfluenced at any part, because the action of gravity upon the surface of the liquid would be everywhere precisely equal. It is essential, therefore, that the tube should be made not only of equal bore, or perfectly cylindrical throughout, but with a uniform and sensibly convex curvature, lengthways, in order that the middle or apex-point of the bubble may rise to, and rest at, the middle or apex-point of the arc.

As, then, the bubble moves in an arc of a circle convex upwards, it may be regarded as a *plummet of air*, analogous to a plummet of metal or a pendulum swinging in an arc of a circle convex downwards; and the centre of gravity of the bubble is brought to rest, by the earth's attraction, in the vertical line passing through the centre of the circle in an arc of which the bubble moves, the same as the centre of gravity of the plummet or the pendulum is brought to rest, also by the earth's attraction, in the vertical line passing through the centre of the circle in an arc of which the plummet or the pendulum swings, or through the point from which they are suspended. When, therefore, the apex-point of the bubble coincides with the apex, or zero point, as it is called, of the tube, which is marked thereon, or the ends of the bubble mark equal distances therefrom, the instrument is in adjustment,—that is, the tangent to the tube at the zero point is horizontal, or at right angles to the vertical passing through that point.

Two symmetrically divided scales are usually engraved across the top surface of the tube—one on each side of the zero-point, or one from each end of the bubble when its apex-point is identical with the zero-point; so that when the bubble marks equal divisions on the scales, the tangent to the arc at the zero-point, as also a visual ray, a straight edge, or a line parallel thereto, is horizontal. When, on the contrary, one end of the tube is raised above the other, the bubble runs from the zero-point towards the elevated end, and the tangent to that point, or the visual ray, the straight edge, or the line parallel thereto, inclines upwards in one direction, and downwards in the other, from exact horizontality, while the tangent to the arc at the apex-point of the bubble, wherever situated, remains horizontal.

When, therefore, the radius of curvature of the tube is known, the scales across the tube are capable of measuring vertical angles with the same accuracy as a sector, whose radius is equal to the radius of the tube's curvature. Thus, when the apex-point of the bubble deviates from the zero-point of the tube, the value in seconds of the angle contained between the horizontal tangent to the bubble's apex-point, and the tangent to the tube's zero-point is

$$206265'' \times \frac{\text{deviation of bubble.}}{\text{rad. of curv. of tube.}}$$

For example, let the bubble's deviation from the zero-point be three divisions of the scale, or $\frac{3}{10}$ of an inch, and let the tube's radius of curvature be 300 ft.; then we have $206265'' \times \frac{\cdot3}{300} = 206265'' \times \cdot01 = 2062''\cdot65 = 34'\,22''\cdot65$, the value of the angle from horizontality.

The radius of curvature of the tube may be found by the formula

$$R = \frac{d}{h} D;$$

where R is the radius, d the deviation of the bubble, h the height traversed on a distant staff by the run of the tangent from the tube's zero-point to the bubble's apex-point, and D the horizontal distance from the bubble's apex-point to the staff. Let $d = \cdot5$ inch, $h = 1$ inch, and D = 600 feet; then $R = \frac{d}{h} D = \cdot\frac{5}{1} \times 600 = \cdot5 \times 600 = 300$ feet.

Hence the longer the radius the less will be the curvature of the tube, and the more sensible will be the bubble of any deviation of the tangent to the tube's zero-point from the horizontal; because the bubble must move over a greater length of the tube in proportion to any small elevation of either end. In delicate levels the curvature is very small, and the bubble quivers with the slightest touch or tremour; while in levels made for common use the curvature is more rapid, and the bubble is more readily brought to a stand, and remains steadier.

The volume and length of the bubble are affected by every change of temperature. The glass and the liquid both expand,—the glass very slightly, the liquid very considerably. If they expanded equally, the capacity of the tube and the volume of the liquid would be enlarged in the same proportion, and the volume and length of the bubble would remain always the same. But, as just observed, the dilatation by heat of the glass is only slight, while that of the liquid is very considerable. Hence the capacity of the tube increases much less than the volume of the liquid; and hence the volume and length of the bubble become smaller as the volume of the liquid becomes larger. This may be verified by heating the tube; when, as the liquid receives heat and expands, the volume and length of the bubble will be seen to decrease; and also by cooling the tube, when, as the liquid parts with heat and contracts, the bubble will be seen to increase in volume and length. Alcohol expands regularly $\frac{1}{1800}$ for every degree of heat that it receives above 32°, and it contracts with the like regularity for every degree of heat that it parts with below 32°.

In common levels the tubes are used just as they leave the glass-factory. Those having an apparent uniform calibre, perceptible convex curvature lengthways, and smooth interior surface, being selected for the purpose; and after the alcohol or the ether is enclosed in sufficient quantity to form a suitable bubble, the ends are hermetically sealed. Now it is evident that if there be any irregularities in the arc against which the bubble runs, they will be imparted to the bubble,—one end of which will be broader or narrower than the other, and shorter or longer from the zero-point; and in proportion to the irregularities will the ends of the bubble be unequally distant from that point, and will the tangent thereto deviate from horizontality.

Should the bore of the tube be uneven or of irregular curvature, or should the parts on each side of the zero-point not be symmetrical, the ends of the bubble, as they augment or diminish in length by changes of temperature, would not rest exactly equidistant from the zero-point, or mark equal divisions on the scales. The tangent, however, to the zero-point would be horizontal, although the bubble would have an apparent inclination; and therefore, to bring the ends of the bubble to coincide with the equidistant divisions of the scales would be to give the tangent an inclination, and throw the instrument out of adjustment. This results more or less with all unground or defective tubes, and consequently sections plotted, estimates made of works, and works set out and regulated from levels taken or given by such tubes must be in error in proportion to their imperfection.

In levels of precision, especially those employed for astronomical and engineering purposes, the interior surfaces are made truly even and cylindrical, and with a sensible curvature upwards exactly to an arc of a circle, by grinding them with emery-powder and oil or water on steel cylinders, and then polishing them. This process is repeated until the bubbles prove, by turning the tubes end for end on a delicately-adjusted support, to be perfectly symmetrical, or until the ends appear at, or mark precisely equal distances from the middle or zero-point, the tangent to which is then horizontal.

Hence, in the preparation of these tubes the chief objects to be attained are, uniformity of bore, perfection of curvature, and smoothness of surface; and it should be observed, in conclusion, that whatever care and finish are bestowed on the exterior mountings of the tube, if the interior of the tube itself be imperfect in the above respects, the tangent given by the bubble will not be horizontal. Tubes have been and can be made to indicate a point half a second of a degree from exact horizontality, or within one-hundredth of a foot of horizontality at the distance of one mile. This slight deviation is due, not to the principle of the instrument, but to mechanical defects, from which no instrument, however delicately made, is absolutely free.

JOHN PHILLIPS.

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* "C'est un instrument où l'air enfermé avec quelque liqueur fait un niveau, mais qui a ces avantages sur tous ceux dont on s'est servi jusques à cette heure.

1. On le trouve plus juste que les autres, car il n'y a point de si petite inclination qu'il ne passe connoistre.

2. Il est d'ailleurs d'autant plus seur pour la pratique, que les changemens de l'air, le sec, l'humide, et le vent, qui altèrent les outres niveaux, ne peuvent en façon du monde corrompre sa justesse.

3. La main de l'ouvrier n'est point occupée à le tenir lorsqu'il s'en sert.

4. L'on emploie moins de temps à s'en servir, qu'à se servir des niveaux ordinaires; ce qui est fort considérable dans une pratique que les ouvriers sont obligez de recommencer si souvent.

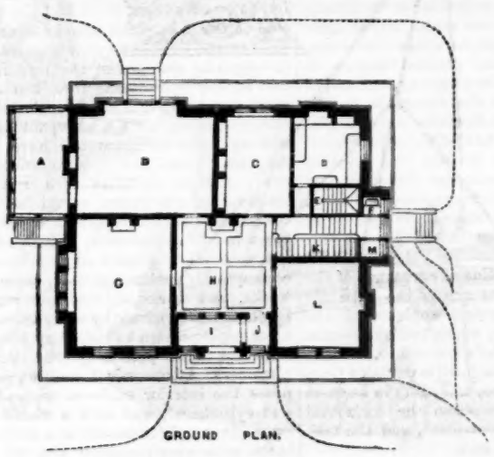
5. La construction en est aussi plus aisée que celle des autres niveaux. On choisit un tuyau de quelque matière transparante; un canon de verre, par exemple, dont les costez soient paralleles; d'un diametre qui puisse recevoir le petit doigt, et qui soit environ sept ou huit fois plus long que large. On le ferme par un bout, et on y met quelque liqueur. L'esprit de vin y est fort propre, parce qu'il ne fait point de sédiment, et qu'il ne gèle jamais. On laisse de tuyau environ un peu moins de ouide qu'il n'a de diamètre; on le bouche après, ou on le scelle par le feu.

Lorsqu'on s'en sert, et qu'on l'applique sur le plan que l'on veut examiner, l'air qui y est enfermé monte aussitost vers la partie du plan la plus élevée, et demeure sans mouvement lorsque le plan est horizontal, et cela toujours avec la mesme justesse, quelque temps qu'il fasse.

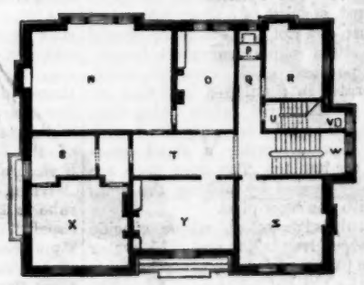
Ce niveau d'air qui donne l'horizon avec tant de justesse, donnera par-conséquent la perpendiculaire sur l'horizon, et tous les différens angles, si vous y ajoûtez les divisions sur lesquelles il les puisse marquer."—*Thévenot, Recueil des Voyages.*

"THE QUARRY," SEVENOAKS, KENT.—Mr. T. E. Knightley, Architect.

VIEW · FROM · THE · NORTH · EAST



GROUND PLAN.



FIRST FLOOR PLAN.

THE QUARRY, SEVENOAKS.

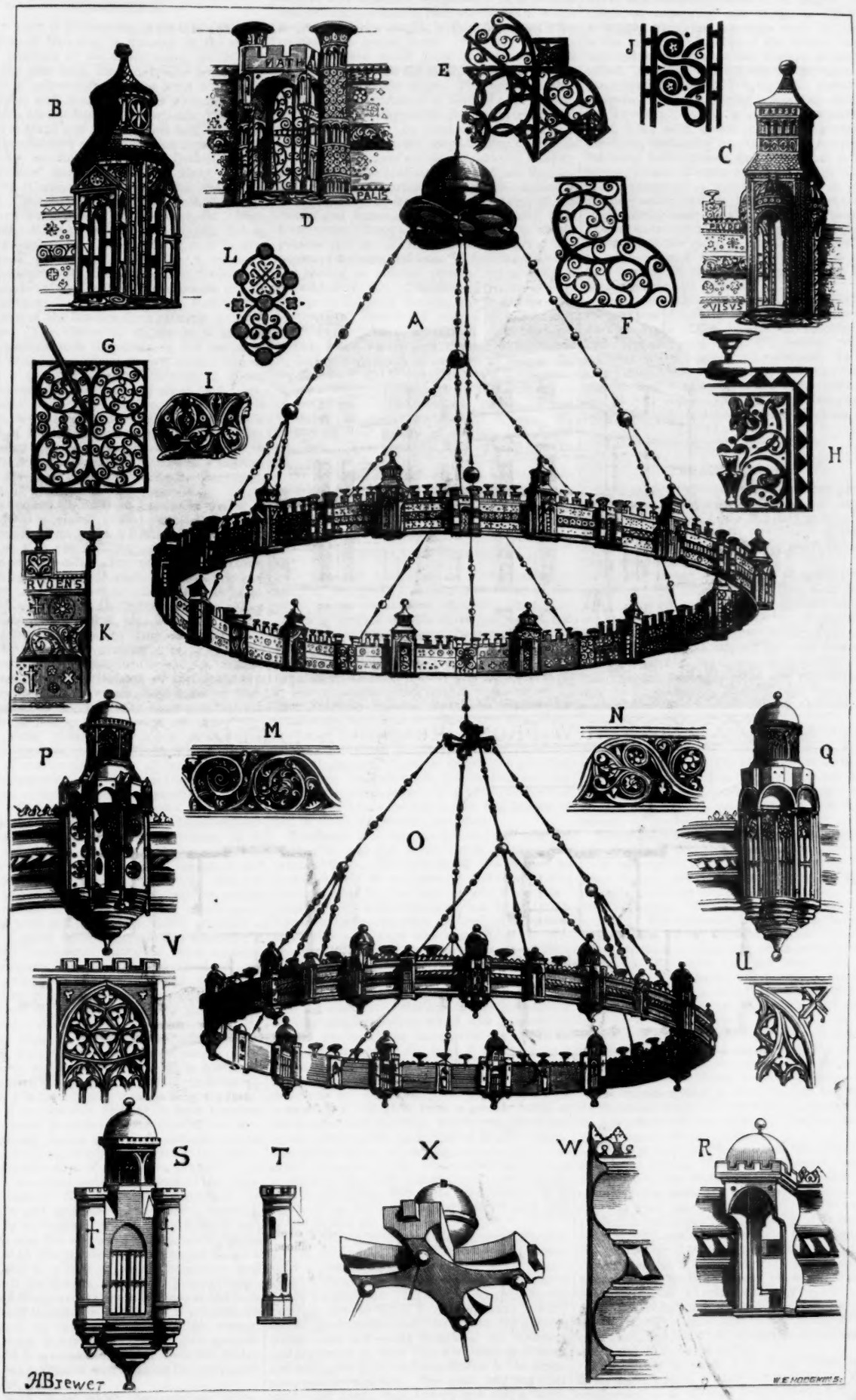
The above engravings illustrate a mansion, together with the entrance-lodge, lately erected for Mr. Andrew Swanzy, in one of the most beautiful parts of Sevenoaks, Kent, on the Kippington Estate, adjoining that of Lord Amherst, and situated about four miles from Knole Park. The works were commenced in the autumn of 1867; the materials used being the Fareham red bricks and Ancaster stone.

The almost invariable practice in building a country house is to erect the offices on the ground-floor level, and lateral to the main building, and rightly so: here there are no trees to screen them. This, therefore, together with the slope of the ground (which naturally created a basement), was taken into consideration, and it was consequently determined to utilize the basement. The house is surrounded by a broad open walled area and an earthwork terrace beyond, the latter sloping towards the grounds, which, with the new planting, prevent them from being overlooked by the windows of the servants' offices. To prevent the smell of cooking and the heat from the kitchen proving annoying, the dining-room being over the kitchen, a match-boarded false ceiling has been constructed, 10 in. below the ordinary one of plaster, and, by means of air-bricks in the external and cross walls, a current of air is maintained.

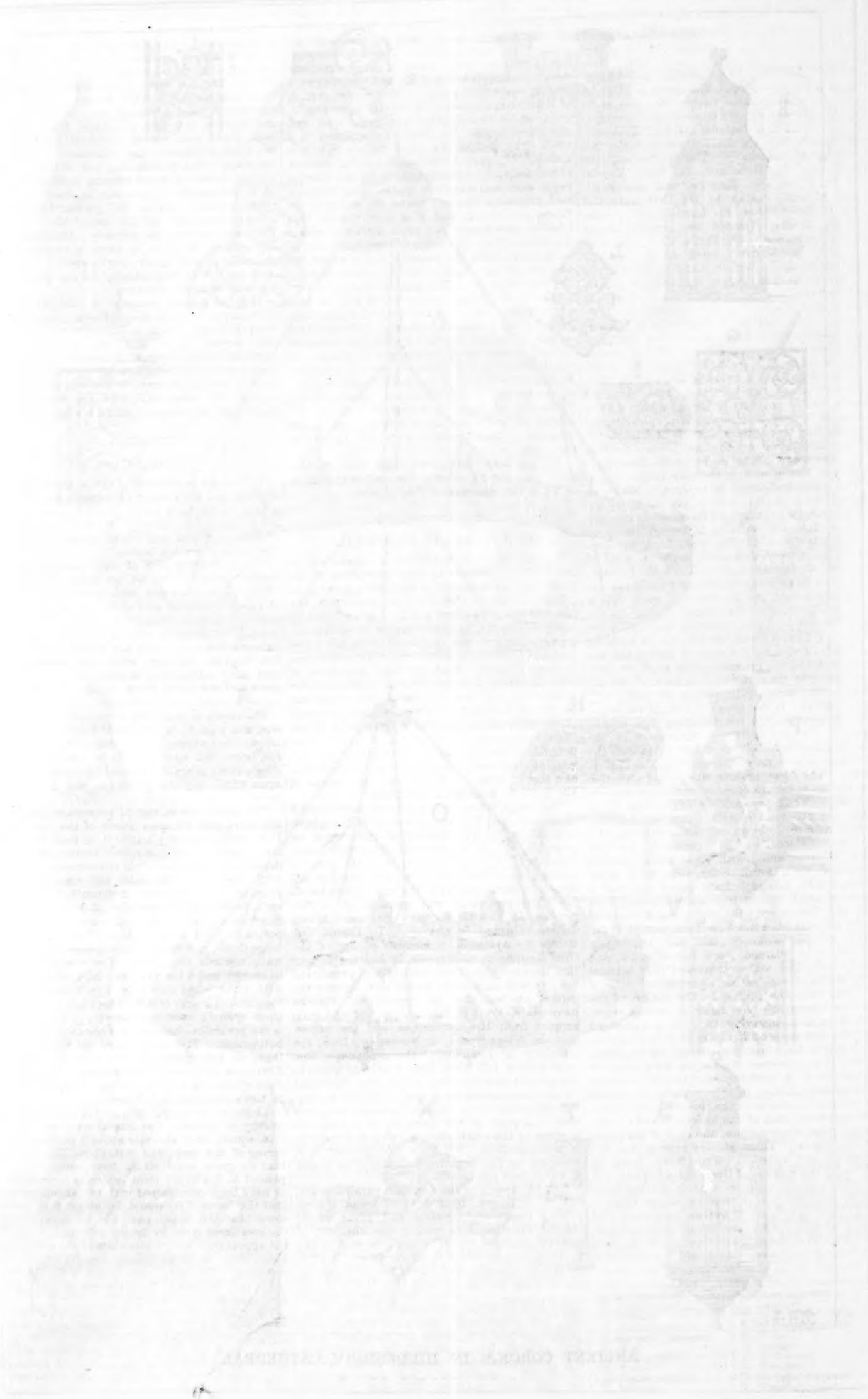
The basement contains a servants' hall, large kitchen, a scullery, dairy, store-rooms, &c. On the ground floor are dining and drawing rooms, conservatory, morning-room, and library; and on the upper floors are ten bed-rooms, two dressing-rooms, and a bath-room. Mr. T. E. Knightley was the architect, and Mr. J. Scott the clerk of the works. The contractor employed was Mr. C. N. Foster, of Whitefriars; the carving being executed from the architect's drawings by Mr. G. Seal, of Walworth. The cost may be considered about 10,000*l*. Not having been able to obtain a scale, we must content ourselves with adding that the house is 56 ft. 6 in. in width, and 45 ft. 9 in. in depth.

REFERENCES.

A. Conservatory.
B. Drawing-room.
C. Library.
D. Butler's pantry.
E. Servants' staircase.
F. W.C.
G. Dining-room.
H. Hall.
I. Entrance-lobby.
K. Staircase.
L. Morning-room.
M. Lavatory.
N, X, Y, Z. Bed-rooms.
O, S. Dressing-rooms.
P. W.C.
Q. Lobby.
R. Bath-room.
T. Corridor.
U. Servants' staircase.
W. Staircase.



ANCIENT CORONÆ IN HILDESHEIM CATHEDRAL.



HILDESHEIM.

The town of Hildesheim, in the lately annexed kingdom of Hanover, is situated in the centre of a province of the same name, which was, until the year 1802, the principality and bishopric of a prince-bishop. The town is of great antiquity, and contains twelve churches, most of which are exceedingly interesting. The population is about half Catholic and half Lutheran, and the churches are divided amongst the two religions as follows: — The Cathedral, the churches of St. Godehard, St. Mary Magdalen, St. Cross, St. Maurice, and the Seminarist Church, belong to the Catholics; and those of St. Andrew, St. Lambert, St. James, and St. Michael (except the crypt), belong to the Lutherans. St. Paul's Church is shut up, and St. Martin's used as a museum. The Cathedral, St. Michael's, and St. Godehard's are wonderful specimens of Romanesque church architecture; they are, perhaps, the most perfect examples of the Basilica form existing in North Europe. The Cathedral stands in a kind of close, planted with lime-trees, in the centre of which is an object which at first strikes one as being a model of Trajan's Column at Rome. This remarkable monument is about 14 ft. high, exclusive of the modern base upon which it stands, and is of bronze, ornamented with a series of figures standing upon a spiral curve, representing scenes from the life of Christ. A modern inscription on the base records the fact that this column was made by St. Bernward, Bishop of Hildesheim, in the year 1015.

The cathedral itself is externally rather a mean-looking church, and is not improved by the ground about it being 6 ft. above its original level, so that the building is buried nearly up to the window-sills. The west front has been rebuilt in a most detestable style—a kind of mixture of Romanesque and Third Pointed. There is a large porch called the Paradise before the western door, and another still more important, being nearly 60 ft. deep, leading to the north transept. Upon entering the church one is terribly disappointed, for the whole building has been thoroughly modernized during the last century, when the greatest pains seem to have been taken to convert every feature of the old church into some abomination of the "pig-tail" period. When, however, one has recovered from disgust at the heartlessness and want of taste of the architects and churchmen of the last century, much will be found to interest the architect or antiquary in the Cathedral of Hildesheim. The first objects worthy of attention are the noble bronze doors of the inner western doorway. They are entirely of bronze, 17 ft. high, and about 10 ft. wide. They are contemporary with the column on the Dom-platz, and are also the works of St. Bernward. The left valve is ornamented with eight square panels, separated by a semicircular rib, richly ornamented with foliage. Each panel contains a series of small figures representing scenes from the Old Testament: the right valve contains eight subjects from the New Testament. These little groups, although stiff and thoroughly Byzantine in character, are full of spirit, and have much more action expressed than is usual with works of such an early period.

Hung from the ceiling in the centre of the nave is the superb chandelier or corona represented in our engraving (A). It is composed of silver and copper-gilt, and is 22 ft. in diameter. It is said to have been commenced by St. Bernward; if so, however, little of his work remains, as the detail is evidently late twelfth century. The general design of this remarkable corona is intended to represent the Heavenly Jerusalem, and originally each of the towers, B and C, contained three silver statues, and each of the gates, D, one statue. These statues represented the prophets and apostles. They were, however, stolen by the soldiers of Gustavus Adolphus, and so great was the violence used in tearing them down, that the corona now no longer forms a circle, but is a kind of broken horseshoe, and nearly all the towers are out of perpendicular. E, F, and G represent the perforations at the back and base of the towers. L, J, and H are patterns in enamel on various portions of the corona. The enamel is dark green, on a gold ground. I, M, and N are the arabesques upon the centre bar. K is a portion of wall showing the perforated ornament, &c.

The next object which demands our attention is the superb rood-screen. This is an early specimen of Cinque-cento work, entirely of stone, and covered with the most delicate and beautiful sculpture. It is divided into five compartments, from the centre of which projects a large pulpit, with a brass eagle for reading the gospel from. The side compartments contain metal gates of very elaborate design, leading into the choir, and low archways leading down to the crypt. The upper portion of the screen consists of a kind of open arcade, upon which is supported the great rood and attendant figures. In front of the screen is a small altar, and on the steps leading up to it is a singular column of red marble, bearing a crown of metalwork for holding candles, of late Romanesque work, and a modern statue. This column is said originally to have borne the statue of the Saxon god Irmen, and it is also related that Charlemagne fought two great battles to obtain possession of it. The choir is exceedingly rich in ancient furniture, and from the roof is suspended the second or smaller corona, represented in our engraving (O). The general design is very similar to the great corona; but it will be seen by the detail that it is the work of a later age, probably the fourteenth century. Like the large corona, it has lost the figures which once adorned it, and is very much beaten out of shape. Of the details, P and Q represent two of the towers; R, one of the gates; S, the back elevation of one of the towers; T, the alternate turrets; U and V, details of upper portions of towers; W, section of wall portion of corona; and X, the pendent. This corona is about 14 ft. in diameter.

On a future occasion we shall continue this description, and give other illustrations of works of art in the cathedral of Hildesheim.

GOOD WORKS IN GUATEMALA.

It may not altogether be uninteresting to many of our readers to hear something of the public improvements that are taking place in so distant a part of the world as Guatemala, the more so as in consequence of the loan of 500,000*l.* lately contracted in this country for public improvements, and the resources there are to be found in Guatemala, a wide field for emigration is opened there. With the kind assistance of Don Enegues, Palaces Chargé d'Affaires for Guatemala, and who is one of the munificent friends of the institution we are about to speak of, we are enabled to give a description of the Girls' Orphanage, which is one of the principal benevolent institutions in Guatemala, and for which a proposed chapel is about to be erected at a cost of 3,000*l.* or more, from the designs of Mr. E. W. C. F. Schmidt, architect.

The design is Gothic in style, and well adapted to the site, and the requirements of the above establishment. The interior of the chapel, as proposed, will be handsomely decorated, using Minton's tiles for the flooring, and the coronæ, sconces, and altar furniture are suitably designed to harmonise with the rest of the building. The orphanage was commenced in November, 1853, with six poor girls, and fifteen dollars collected in charity. To Donna Luz Batres de Aycinena, a member of one of the chief families in Guatemala, is due the honour that the execution of the noble idea of presenting the city with an asylum which now honours the capital, has been thus far carried out. Poor as its origin was, yet in due time it met with such support from the authorities and the public, that, in fifteen years, in November, 1868, the ceremony of removing "the orphanage, now consisting of 120 girls, from a private house to the present new building, which was purchased by the Government at a cost of 20,000 dollars, was celebrated in a manner becoming the occasion." A proof of the liberality of the citizens is given by the establishment being now capable of accommodating 300 girls. At present it is occupied by 120 orphans, maintained at a cost of 400 dollars per month.

The building is in the form of a parallelogram, 473 ft. in length, by 258 ft. in breadth, comprising twenty-eight rooms and seven quadrangles, distributed in such a way that out of 44434·6 square feet 12217·5 are occupied by the building, and by 921·3 ft. of corridors; 16492·7 by the quadrangles, and 14803·3 by the garden, which runs the whole length of the building, and separates it from the surrounding houses, and also gives light and ventilation to the class-room and dormitories. The main building runs north and south, and has on one side a corridor 440 ft. in a straight line, giving access to the temporary chapel (68·9 ft. in length), to two workrooms 60·6 ft. each, while situated above is a dormitory 239·3 ft. in length. The refectory, occupying one wing, is 137·6 ft. in length, which has a terrace roof. Adjoining is the laundry. Another of the wings running east and west contains the kitchen, stores, and offices. The two wings divide the premises into three quadrangles, 4,875 ft. square. Parallel to the refectory and adjoining is a gallery covering the laundry, in which is situated the washing-tank, fitted with eleven divisions for washing the linen, containing also hot-water apparatus, hot-water baths, closets, &c., and it has a continuous stream of water running through it. In each quadrangle a fountain is erected, with running water, and in the garden there is a large bathing-tank for the use of the inmates. The establishment is partially maintained by the work of the girls, in washing, making lace, embroidery, and other needlework. Especial care is given in the training of the girls to fit them for domestic servants.

This state also contains a hospital, which relieves yearly 5,000 sick persons gratuitously. Another large public building is occupied by 100 orphan boys and 80 infirm people, amongst whom figures conspicuously an old king's messenger, who formerly rode from Guatemala to Mexico, and who is now at the advanced age of 100 years, and, with the exception of being deaf, in possession of all his faculties.

PENARD CASTLE.

This castle is situated in the southern part of Gower, upon the margin of Oxwich bay, and on a cliff which here forms the left bank of the brook which descends by the two deep valleys of Park-le-Broose and Ilston to reach the sea a few yards below the castle.

The bold abrupt cliff of rock occupied by the castle and indicated by its name, rises about 150 ft. above the water, and, in common with all the east or leeward side of the bay, is capped by a deep deposit of wind-blown sand. This sand, not now in progress, widens out into extensive barrows, parts of which are covered with short but fragrant herbage, while the remainder is arid sand, contrasting sharply with the fertile grass and woodland which occupy the west and more favoured side of the bay.

The castle is an oblong enclosure about 108 ft. east and west by 84 ft. north and south, at its longest and widest. The sides are flattened and the west end rounded. It is composed of a single court or ward, enclosed by a curtain-wall, upon which are the gatehouse and one mural tower.

The gatehouse is, out of proportion, large for the court, and occupies much of the east end. It is rectangular in plan, 40 ft. in front by 23 ft. deep, having two half-round towers, 15 ft. in diameter, between which is the entrance-gate, of 10 ft. opening. The sides and rear are rectangular. The entrance is beneath a flat drop arch, backed by the remains of a vaulted roof, in which are the chase and usual grooves for a portcullis. On either side are loops; but the lodge doors, now broken down, were in the rear wall, towards the court. The towers have a basement and a low first and lofty second floor, with three loops outwards, 2 in. broad, and of the unusual length of 6 ft. There are also lateral doors opening upon the curtain. In the centre is the portcullis-chamber, and above it the usual battlement. The floors were of timber, and there do not appear to have been stone stairs. There are no traces of a drawbridge, though the ditch shows one to have existed. The rear parts of this gatehouse are in ruins.

There is one peculiarity about the portcullis worthy of notice. The lateral grooves, about 5 in. square, stop abruptly about 2 ft. below the spring of the arch, and 6 ft. above the cill, so that the grate must either have remained suspended at the upper level, which is improbable, or have been constructed with two shoulders, so that the lower 6 ft. would be about 8 in. narrower than the upper part, and be deprived of the steadiness given by lateral grooves. It does not appear from the ruinous state of the entrance what other defences existed besides this one portcullis. The gatehouse is not in the centre of the end, but has 12 ft. of curtain on its south wing, and 30 ft. on its north.

The curtain is about 3 ft. 6 in. thick, and 20 ft. high, within, to the rampart wall. The battlement is of unusual height, about 8 ft., so that the wall outside is at least 28 ft. high. The embrasures are far apart, the merlons being very broad, and some of them are pierced by a loop.

This curtain remains tolerably perfect from the gatehouse along the north side, and round the north-west corner. A short piece also remains on the south side. The rest is gone. On the curtain, near the north-west end, is the sole mural tower, half round, about 12 ft. diameter outside, and closed by the curtain, in which is the door. The upper floor was open in the rear, and entered from the rampart wall. There was no stone stair, and the roof was of timber.

Close east of this tower, in the curtain, is a small high recess with a segmental arch. There is a gardrobe on the inner ground level. Its place is marked exteriorly by a flat pilaster buttress, in which is the shoot, opening at the foot of the wall. It is probable that a second shoot descended from the ramparts.

Outside and against the north-west corner of the curtain has been added a rectangular building, 18 ft. deep and 20 ft. broad within, with walls 3 ft. thick. This is of one floor of less height than the adjacent ramparts, and it had two large windows, one to the south and one to the west. In another position it might have been a chapel. It was probably some kind of hall, added when the country was at peace, though its position on the cliff would render it moderately secure.

The castle on the north and west faces is protected by a steep cliff. Towards the south and east was a ditch, now partially filled up by sand. There were probably lean-to dwellings round the court, in one place indicated by a loop. There are, however, no remains of buildings.

The material is the quartz conglomerate known as millstone grit. The workmanship is a very inferior rubble, only partially coursed. There is no trace of ashlar in the place, and, excepting over the entrance, probably never was any. This castle has no history, and enjoys the rare, if not singular, distinction of having been omitted in the Ordnance Survey of the district. Its general plan, and such details as remain, refer it to the reigns of Henry III. or Edward I., probably the former.

About 100 yards south-east of the castle, near other foundations, are the remains of the ancient parish church of Penard, now *Consumptam per Sabulonem*. This was composed of a nave 45 ft. by 20 ft. within, with walls 2 ft. 6 in. thick, and a chancel 20 ft. by 15 ft., in the broken-down walls of which are traceable a south window, with a deep splay and a 2 ft. opening, and a cavity for a piscina. The piers of the chancel arch were thick, with a narrow opening, and probably Norman. On the outside of the north pier is a thickening of the wall. Of the nave only the foundations remain, save of the west wall, which is tolerably perfect, showing the usual putlog holes, and the gap for a moderate west window.

Penmaen Church, in the adjoining parish, has in like manner been swallowed up and deserted, as here, for a later building, placed out of the reach of the sand. C.

MISTAKES IN TENDERS.

In the Vice-Chancellor Stuart's Court, on Monday, May 24, the case of Neill *v.* The Midland Railway Company was tried.

This was a demurrer. The facts, as stated in the bill were these:—

In January, 1866, the Midland Railway Company advertised for tenders for the erection of certain buildings on their premises at Leeds, and at the same time they issued a form of tender with a schedule of quantities for the intended works. Shortly after the date of the advertisement, the plaintiff, James Neill, a contractor residing at Bradford, applied for a form of tender and schedule, which, having been sent to him, he filled up and returned to the defendants.

An agreement was entered into between the parties, and soon after its date the plaintiff began to erect the works, but, before their completion, disputes arose between him and the defendants as to the execution. An arrangement was then entered into that the defendants should complete so much of the works as remained unfinished, and charge the plaintiff with the cost.

The plaintiff, in filling up the schedule of quantities annexed to his tender, had inserted after each item what he considered would be the total amount of the cost in reference to the item. In calculating these amounts, however, he had inadvertently made several mistakes, some in favour of himself, and others in favour of the defendants. In one instance he had stated that 5,086 yards of concrete at 5s. per yard would amount to 55*l.* 19s. 2d. instead of 1,271*l.* 10s. In another he had set down 1,974 yards of concrete at 5s. per yard as amounting to 41*l.* 3s. 6d. instead of 493*l.* 10s. The result of these various mistakes was, that there was a balance of about 1,881*l.* 0s. 2d. too little.

The plaintiff alleged that the defendants' architect and engineer, or one of them, either before or immediately after the date of the agreement, knew of the mistakes; that he himself did not discover them till November 1868, when he immediately applied to the defendants to have them rectified; but this they refused to do, and insisted that he was only entitled to the sums mentioned in the agreement.

Thereupon the plaintiff filed his bill, praying that the schedule of quantities might be rectified.

In support of the demurrer it was contended that the Court had no power to relieve persons from the consequences of their own negligence. The plaintiff had offered to do the work for a certain gross sum, and on the faith of that offer his tender was accepted by the defendants. The agreement was binding on both parties. Plaintiff's allegation that the defendants' architect and engineeer knew of the alleged mistakes was unsupported by evidence. They referred to Wason *v.* Wareing, 15 Beav. 151; Story's Eq. Jur., s. 146, *et seq.*

The Vice-Chancellor said,—There is no pretence for this demurrer. It is the ordinary and well-established practice of this Court to grant relief in cases arising out of mistake. In the present instance the mistake is so palpable that it appears to me strange that the defendants should wish to take advantage of it. The demurrer must be overruled with costs.

A BUILDING ON CHAT MOSS.

The 3rd Manchester Regiment of Volunteers have recently erected a new building at the shooting range, about eight miles from Manchester, and near Worsley Hall, and which is upon a portion of Chat Moss, noted as having presented one of the earliest and most formidable difficulties in railway engineering. Where the building is erected the moss was found to be 22 ft. deep, necessitating the use of piles, and upon these the pavilion was erected in the fifteenth-century style of timbered houses, of which so many good examples are found in this and the adjoining county of Chester. The style has the advantage of making the superstructure much lighter than a building constructed wholly of brick would have been. It is planned in four distinct compartments, forming quarters for officers, non-commissioned officers, members, and a cottage, with store-rooms and other conveniences, for the range-keeper, all having connexion with the bar. The officers' mess-room has an open roof exposing the timbers, and these, with other woodwork, are stained and varnished. In the upper portion of the tower are the prospect and smoking-room, and from which the officer in charge of the range has a perfect view over the ground. It is surmounted by a staff on which the flag denoting firing is hoisted. On the vergeboard of the centre gable is carved the motto adopted by the Volunteers of Great Britain—"Defence, not defiance." The building was designed and superintended by an officer of the regiment, Ensign Redford, architect.

OPENING OF A NEW IRON PROMENADE PIER AT DOUGLAS.

The new iron promenade pier at Douglas, Isle of Man, has been opened with much *éclat*, the ceremony of christening the pier being performed by Mrs. Loch, wife to his Excellency H. B. Loch, C.B., Lieutenant-Governor of the island. The pier runs out 1,000 ft. from the end of the present promenade, and at the outer end it is 35 ft. high, and in about 22 ft. of water at high water of ordinary spring tides. The pier is a light iron structure, similar in construction, but on a much smaller scale, to that at New Brighton, and is 1,000 ft. in length, and 16 ft. in width. The quantity of iron used in its construction was 301 tons, and of timber 5,000 cubic feet. It is supported by 76 piles, placed at intervals of about 14 ft. The principal entrance to the pier is from the shore road, and will be reached by means of a flight of broad stone steps, which will shortly be constructed. There are, however, two side entrances from the promenade by means of a curved ascent. The pay-house, with entrance-gates, &c., is in the style of a Chinese pagoda. Each person passes through a turn-stile, which will only move by the pay-taker placing his foot upon a plate inside, and every time he does so it registers, thus keeping a check upon the amount of money received. The railings and posts along the pier are painted in variegated colours, and seats are placed at each side of the pier, and at the outer head a pier-head has been formed. This pier-head is 90 ft. by 40 ft., with a flight of iron steps leading down to a landing-place for small boats. There is also a refreshment-house erected here, with a flat roof, on which a band can be stationed. The engineer and contractor for the pier was Mr. John Dixon, of London; and the resident engineer by whom the work was carried out was his brother, Mr. Wayman Dixon. The contract was for 6,000*l.*, or about 6*l.* per foot, and the work has been carried out for the estimate. Mr. John Dixon is engineer for the steam landing-stages in connexion with the Thames Embankment, and also for the extension of the Southport pier. The pier has been put to the tramp test, as a large body of the Douglas Artillery passed over it in military order. No shake or oscillation took place.

ARCHÆOLOGICAL EXCURSIONS.

The Sussex Archæological Society.—The annual general meeting of this society was held at West Grinstead. With the exception of the parish church, there is very little in this parish to interest the archæologist; but the park, belonging to Sir Percy Burrell, presents some beautiful scenery, and the society were favoured with delightful weather. Steyning Church was visited, and the Rev. T. R. Turner read a paper by his father, the Rev. E. Turner, of Maresfield, on the subject. Many of the visitors then went to the vicarage to see the carved wainscots there. West Grinstead Church was then examined, and the house and park, with the old oaks, under which Pope sat about the time when he wrote the "Rape of the Lock," were visited, as also the parsonage house and the ruins of Knepp Castle, a paper on which was read. After seeing the Shipley reliquary, the members proceeded to their large marquee in the grounds of Knepp, where the business meeting was held, followed by the usual repast, the Rev. E. Turner, chairman of the committee, in the chair.

Cambrian Archæological Association.—The last excursion of this Association for the season has taken place. The party went first to Laleston Church, and then to the church at Newton Nottage, Maudlam Church, Kenfig, and Margam Abbey, where they had luncheon in the orangery with the Lord Lieutenant of the County, Mr. C. R. M. Talbot, M.P. Afterwards they went through the grounds, and Mr. Freeman gave a description of the building. A business meeting was held in the evening.

Sheffield Architectural and Archæological Society.—There has been an excursion of this society to Haddon Hall. In the old banqueting-hall there were two papers read, the first by the president, the Rev. J. Stacye, giving an account of the early history of the place, which was followed by Mr. J. D. Webster showing its character and arrangement compared with buildings of earlier and later date. After partaking of tea at Bakewell, resolutions were passed deciding to have the *conversazione* in the autumn, and appointing a sub-committee to make the necessary arrangements.

DRAINAGE, RAILWAYS, AND SMOKE.

Sir,—Your last number is an interesting one. From page 669 I am glad to learn that they are about to erect a large water-wheel at Windsor falls (Eton side). I suggested it in the *Builder* some months ago. In the same column, Herr E. Krejcsy is mentioned as the *inventor* of a new system of signalling from train to train while running or standing on the line, by transmitting electricity along the iron rails. Perhaps you, sir, may remember a letter of mine on the above precisely. I hope the present promoters may carry it out.

Smoke-town fumes down trillions of blacks;
Billions of chimneys, millions of stacks;
Thousands languishing amidst the smoke,
Hundreds eye-dimm'd, and some quite choked.
One will arise and remedy bring—
Laud and reward him, pæans sing;
A clear blue sky, the free air pure,
Honour to him who'll work the cure.

R. T.

ARCHITECTS' WRONGS AND RIGHTS.

"An Architect" writes,—"A builder, who is now carrying out a building from my drawings, has actually copied my plans in every respect for a client of his, and is now building the very house not a quarter of a mile from the one he is carrying out from my designs. This is very annoying. Can I not make him pay me the commission on the amount of his contract, inasmuch as the house is exactly the type of my plans?

Some one or two of my clients have made a call for the plans and specification, and conditions of contract that I have carried out for them; and I have told them, in justice to the profession, that they belong to me, and have refused to deliver them up. Have I not acted rightly in doing so?"

By the custom of the profession, and the printed Declaration of the Royal Institute of Architects, the drawings and specification belong to the architect. As to the shameful theft of his design complained of by our correspondent, the law is in so bad a state, that the case would have to be looked into very carefully before it could be said a remedy did or did not exist. If our correspondent will send the name of the builder who has given this extra publicity to his design, we will print it, so that at any rate other architects may know what builder to employ when they desire a similar result.

ARCHITECTS' CHARGES.

You will oblige by inserting the accompanying brief reports from the Dublin papers of two arbitrations recently held, in which I was concerned, and in which the rates of charge set forth in the Institute scale have been recovered. It is undoubted that in both these cases the opposition was grounded on the indecisive result of an important case tried in Dublin last year, in which two architects, one a member of the Institute, appeared and gave evidence directly contrary to the Institute scale. On this account I was given to understand that as these charges were thus publicly contradicted by members of the body who published them, they would not be recognised. However, as I was determined to bring matters to a proper issue, notwithstanding this, and the certainty that the same architects were ready to do the same again, my opponents gave way, and reluctantly consented to arbitration under orders of Court, but resorted, as a last device for evading payment, to the expedient of trumping up counter claims against me for damages for real or fancied defects in the work. These, as you will see, were soon exploded, and verdicts given in my favour for nearly the full amount in both cases, carrying with them costs against the opposite parties, amounting, in one instance, to three or four times the amount in dispute.

These cases will, I think, serve to show the mischief that the architects who gave evidence against the rates of charge now generally adopted throughout the profession have done, not only to the profession, but to the public, setting them by the ears on questions on which there ought to be no room for difference of opinion. However, though it is no satisfaction to me to have to go through these contests and mulct my opponents in enormous costs, it is some satisfaction to have decisions given in accordance with the principles contended for, and which I hope will form useful precedents, and prevent litigation on the same subject in future.

W. Fogerty.

Arbitration Room, Four Courts, Dublin, August 16-17.—*Fogerty* v. *Hazleton & Others, Hazleton & Others* v. *Fogerty.*—These cases, which came on for trial after sittings in the Court of Queen's Bench, and were ordered by Mr. Justice George to be referred to arbitration, have just been decided by the arbitrators, Messrs. John Sibthorpe, Samuel Boyd, and John M'Curdy. The first action was brought by Mr. William Fogerty, architect, of Harcourt-street, to recover his fees for the design and superintendence of the new warehouses of Messrs. Hazleton & Co., drapers, in Henry-street. His claim was for 5 per cent., on the total cost, nearly 8,000*l.*, and sundry incidental charges as per the scale of the Institute of Architects. Of this 275*l.* had been paid on account, but beyond this (though they had tendered 56*l.*) the Messrs. Hazleton lodged nothing in court, pleading that no work was done. The second action was a cross claim for damages, laid at 400*l.*, brought by Messrs. Hazleton & Co. against the architect for alleged negligence in overseeing the work, in consequence of which the builder (Mr. Michael Meade) had been allowed to execute the plastering in an improper manner. The architect denied the negligence, and filed a special defence that he had, under the contract, withheld his certificate from the builder, and employed another builder to remedy the defects, and that while doing so Messrs. Hazleton & Co. had entered into an arbitration with Mr. Meade on the subject of the alleged defects, which had all been already adjudicated upon; also, that he had been at all times ready and willing to direct the remedy of said defects, but was prevented by plaintiffs; and that the said defects were not of the nature and extent alleged.

After examining numerous witnesses on both sides, and viewing the premises, the arbiters awarded to the architect in the first action the sum of 150*l.* beyond the amount paid, making 425*l.* in all. In the second action they found that Messrs. Hazleton & Co. were not entitled to any compensation from the architect. The costs of both actions, and of the arbitration, to follow the award, and be paid by Messrs. Hazleton & Co.

The New Wesleyan College, Belfast.—An important arbitration was held recently at the rooms of the Church of England Young Men's Association, Belfast, between the committee of the above college and their architect, Mr. Wm. Fogerty. The result has just been declared. It appeared that the committee of the college having, in the year 1864, invited a limited number of architects to submit designs for the building, the design of Mr. Fogerty was selected, and the work has been since carried out under his direction, at a cost of about 16,000*l.* His claim amounted to somewhat over 1,000*l.*, out of which 555*l.* had been paid during the progress of the work. It was made up of the usual commission of 5 per cent., travelling expenses, and other items, in accordance with the scale of charges of the Institute of Architects. This the committee refused to recognise, alleging it to be excessive, and the matter having been referred, by mutual consent, to Sir Charles Lanyon, the committee also brought forward certain counter claims against the architect for alleged delay, and defects in the work. The matter having been carefully investigated, and the building examined by the arbitrator, he awarded the total sum of 940*l.* to the architect, the balance of which is to be paid him after giving credit only for the sum paid on account.

TILES.

Sir,—Will any of your correspondents inform me whether nibs (formed on the tile) to hang on the lath, or holes in the tiles for nails or pins, are best when flat fancy tiles are used for roofing?

If holes, whether cast-iron pins, to hang over the lath, or copper or iron nails, to drive into the lath as they are used for slates. D. D.

THIN GLASS.

Sir,—I am the father of a small family, occupying a new house near Finsbury Park, rent 63*l.*, purchase 800*l.* Most of the windows are glazed in four large squares, with glass so very thin and brittle that it affords no protection from weather, and leads to daily breaking,—a most expensive tax on my purse. I see by your advertising pages thick stout sheet glass is very cheap. Cannot you persuade builders to use something stronger, to save tenants' pockets (rents are dear enough) and injury, by constant hacking out, to the window sashes? 26 Ounces.

A BUILDER'S "PLANT."

There is at present in the possession of Mr. George Terrey, a builder in Clerkenwell, says the *Gardener's Magazine*,—

"a most remarkable plant, for which the owner has refused considerable sums of money. It is about the size of an ordinary gooseberry bush, and, although living and growing, bears no semblance of vitality. It has no foliage, but little pellicles of flint bud out of the twigs and stems, which are likewise encircled with rings of flint at every joint. In some places the flint, which, it appears, has exuded from the plant itself, cases the stems like a pipe. The plant looks black and dead, but the twigs, instead of being brittle like dead wood, are tough as leather thongs. It has been suggested that the flint, which forms so large a component of plant life, has, by some freak of nature, been eliminated in this case from the natural vesicles of the plant, and developed outwardly instead. Scientific men from various public institutions and learned bodies have inspected this phenomenon, but without arriving at any conclusion respecting it beyond its indubitable singularity."

The "plant" here referred to is simply a large arm of black branched *coral*, the pieces of "flint" exuding from it are *sea-shells* naturally embedded in the coral; as to its living and growing, that is a mere invention, as it has not grown since it came out of the bottom of the sea. So far from its being the truth that scientific men can come to no conclusion regarding it, its true nature has been fully explained to the proprietor by competent persons; amongst others, by a gentleman attached to this paper.

The owner keeps it *well watered* in a large flower-pot, but he cannot be induced to turn it out, and thus expose the stump of the coral.

MARGATE CESSPOOLS.

Sir,—I have recently spent a fortnight at Margate, to which town thousands of Londoners flock, by steamboat and rail, during the summer, to endeavour to benefit their health. But, to my surprise, instead of a well-drained town, I found the most reeking cesspools abounded. In the higher part of the town, adjacent to Hawley-square, the houses have W.C.s built over these stagnating abominations; and the wonder is that fever and diarrhœa do not more prevail. Diarrhœa was the common complaint. On the road leading to the country, I was invited to go over one of the new houses just finished, and the proprietor, who accompanied me, after pointing out the advantage of two W.C.s, in reply to my inquiry as to drainage, said, "Oh! there is a cesspool. The chalk is so porous that nothing more is required. If the contents were not emptied for twenty years, there would not be a bushel of refuse!" When such is the opinion of the builders of the present day, what sanitary arrangement can be expected in the houses of the past?

Another advantage (?) pointed out was a small room in the upper part of the house without a fireplace, "which would just suit a servant!" *Punch* recently showed a sleeping-place in a cellar, but then it was *only for a servant!*

Visitor.

ST. CATHERINE'S, BREDA.

The new church of St. Catherine, at Breda, in Holland, was opened with much pomp and splendour on Wednesday, August 11th. The church, which is the largest that has been erected in Holland since the Reformation, is of noble proportions, and consists of a nave, with double aisles on either side, large transepts, and a long and spacious choir. There is a central lantern, and we believe it is proposed eventually to erect towers at the west end. The whole church is vaulted, and there is a large triforum over the nave aisles, which serves the purposes of a gallery, likewise vaulted. We believe that the church is to be used as the cathedral for the Roman Catholic diocess of Breda. The architect of the building is Mr. Cuypers, who has also just completed a fine church at Eindhoven.

CHURCH-BUILDING NEWS.

Warwick (*Cumberland*).—The parish church, which has during the last two or three months been partly rebuilt and repaired, has been re-opened for divine service. The north wall has been rebuilt from the foundations, and the south wall from the window-sills. On the north side a vestry has been added. At the west end a temporary porch of brick has been erected. The roof has been replaced by a new one of slate and finished stone. The material used is red sandstone, which matches that of which the old walls were composed. Within, a new chancel arch has been substituted for the old one. It is formed of multi-circular pillars, with small floral designs round the capitals, and a carved stone face at each side. An old Norman arch in the west end, which has until now been closed up, has been opened out. The windows are double lancet, the glass being parti-coloured, and each window surrounded by a rim of coloured glass. The circular apse at the east end has not been interfered with, except so far as regards the replacing of the roof. It is lighted only by one small window of stained glass at the east end. The church has been reseated with varnished open seats.

White Waltham.—The church here has been re-opened. The new church has been built from plans by Mr. G. E. Street, of London. Mr. R. Silver, of Maidenhead, was the builder. The church, except the chancel and mortuary chapel, has been entirely rebuilt. The original Norman and Early English character of the building has been preserved. A north aisle has been added in addition to a tower with staircase turret at the north-west angle. The tower is opened into the church by a stone arch and groined ceiling under the floor of the ringing-chamber, and is lighted by a three-light window. The aisles are separated from the nave by an arcade of two arches on circular columns with carved caps. The floor throughout is laid with Godwin's tiles, and the chancel floor is laid with encaustic tiles inlaid with marble. The church is fitted with open seats of slightly stained deal, and the stalls in the chancel are of oak with carved poppy-heads. The pulpit is of stone, with Norman arches, and is circular in shape. On the south side of the chancel is the mortuary chapel, which has been restored to its original and Early Decorated character by Mr. C. Ellis, of Waltham Place. It is filled with oak stalls and deal seats. On removing the colouring from the chancel walls, a mural painting, covering the whole of the surface, was discovered; and on taking down the walls of the old tower a group of carved alabaster figures was found embedded in the wall. These figures, it is supposed, formed part of the reredos of the ancient church. Two stained-glass windows have been placed in the south aisle, in memory of the late Dr. Vansittart and his daughter. The subjects are "The Good Shepherd" and "The Sower." Mr. Wales, of

Newcastle, was the artist. There is a two-light window in the south aisle, by Mr. R. Silver, in memory of his mother and sister. The subjects are "The Baptism of Christ" and "Suffer little children to come unto Me." These windows were executed by Messrs. Clayton & Bell, and designed by Mr. Street. The whole of the iron work has been carried out by Mr. Leaver, of Maidenhead. The five bells will be recast by Messrs. Warner & Son, of London. The porch is built of old oak. The Communion cloth was designed by Mr. Street. Upwards of 1,000*l.* are still required to clear off the expenses incurred.

Uldale. — The new church at Uldale has been consecrated. It has been erected at the cost of the late Professor Cape, of Addiscombe College, Croydon, whose wishes have been carried out by Mr. Canon Cape and Miss Cape, of Peterborough. The church, which is seated on a slight eminence at the end of the village, is of the Decorated style of architecture, and is terminated by a tapering spire. It stands in a walled enclosure, and contains accommodation for 150 persons. It was built by Mr. Sheffield, after the design of Mr. Grayson. Immediately above the altar is a stained-glass window, the centre compartment of which represents the Crucifixion, while the miracles of Peter are depicted on the other portions.

Wootton Basset.—The trustees of Sir Henry Meux, bart., at this place, have recently been granted permission by the Lord Chancellor to expend the sum of 5,000*l.* in the restoration and enlargement of the parish church. This sum will enable the architect, Mr. Street, to place painted glass in one or more of the windows. The trustees approve of the site for a burial ground, selected by the ratepayers. It is said that the owner of some property near this place, and who objected to it, has withdrawn his opposition.

Howden.—The parish church is being restored. The cracked bells have been sent away to be recast, the whitewashed altar-screen is being restored, and the organ has been removed and repaired. The pews and woodwork have shared in the work of restoration. There is still a further sum of money required, but everything necessary to be done to complete the restoration can be accomplished for less than 1,000*l.*

Maidstone.—The temporary iron church which has for a long time done duty for this district, is shortly to be superseded by a more substantial structure. 820*l.* have already been promised by various church-building societies, and the work will be commenced as soon as sufficient funds are provided. Designs have been submitted by several architects, and one prepared by Mr. E. W. Stephens has been selected. The plan consists of nave, apse, chancel aisles, tower at angles, vestry, &c., in the Decorated style. The interior will have an arcade of five bays and range of clearstory lights, an open timber roof, chancel arch, and chancel, the latter formed for coloured decorations, both upon the roof and around the walls. The church is to be built of ragstone, with Bath stone dressings, and at the south-west angle a tower, 150 ft. high, is to be erected. The tower is to be apart from the angle of the nave.

Handsworth. — The chancel of the parish church, which has suffered even more from the hands of modern church builders and renovators than from the decay of old age, is about to undergo a restoration at the hands of Messrs. M. E. Hadfield & Son, architects. The works comprise, amongst others, a new roof of the original steep pitch, of English oak, carved and moulded rafters, the removal of the modern debased windows in the south wall (which are to be reconstructed in a style conformable with the old architecture), and a new chancel arch. The stonework will be cleansed and repaired. These various alterations have a good authority in an old drawing taken about forty years ago by the late Mr. J. Hibberd, showing the then existing state of Handsworth Church; and this drawing has been a guide to the architects in the identification of various old features in the building. The works have been let to Messrs. Greenwood & Son, masons, Handsworth Woodhouse, and J. Hayball, joiner, &c., Sheffield, and a commencement has already been made, in the course of which a double sedilia of thirteenth century date, with a piscina, hagioscope, and other matters of interest, have been brought to light. The Norfolk Chauntry will be opened out and seated with open oak benches, and in the chancel are to be oak choir seats and fittings of a suitable character. The church dates from early in the thirteenth century.

DISSENTING CHURCH-BUILDING NEWS.

Nottingham.—The General Baptist Chapel in Broad-street has been re-opened after having undergone considerable alteration and improvement. The seats were narrow and uncomfortable, and the gallery objectionable for several reasons. In addition to this there was no place in which to erect an organ, and these things, rather than the actual want of room, induced efforts to be made to entirely renovate and alter the building. The sum of 1,100*l.* was raised by the congregation, and the work was at once commenced, Messrs. Booker, of Short Hill, being the architects, and Messrs. Ellis & Son, the builders. The actual number of sittings has not been increased, but the area of the place has been extended. A new front in the Italian style of architecture has been built nearer the street, the seats have been improved, and the gallery made more commodious. The ventilation has also been made better. At the far end, behind the pulpit, an organ has been erected by Messrs. Lloyd & Dudgeon, on each side of which the singers are arranged. The organ will cost about 200*l.* The entire expense of the whole alterations, including the organ, will be about 1,600*l.*

Camelford.—The foundation-stone of a new Wesleyan chapel has been laid at the old Delabole slate quarries, by Mr. John Allen, of Ivybridge. The present edifice which was erected in 1808, and enlarged about the year 1850, has now become too small, but it will be kept for the use of a flourishing Sunday school. The builders are Messrs. Hitchins & Paull. The interior dimensions are, 54 ft. in length, and 31 ft. in breadth, and accommodation will be provided for about 275 persons. The entire cost is estimated to be from 600*l.* to 650*l.*

ROMAN CATHOLIC CHURCH-BUILDING NEWS.

Petworth.—A new church in Burton Park, has been opened for divine service. The church, which is dedicated to St. Anthony and St. George, is in the Transition style of architecture, and the total cost is stated at about 3,000*l.* On either side of the inner doorways there are aumbreys, the porch itself being lighted by windows of peculiar construction, and fitted up with Caen stone benches or seats. In the gable of the porch are canopies, containing statues of the patron saints, and it is surmounted with a foliated cross. The slender columns that support the arcading of the nave are four in number, the arches being of Caen stone, with moulded caps and bosses. There is also a moulded arch carrying the organ-loft, and another of a similar character over the font. The chancel arch is supported by columns of polished Devonshire marble, with carved capitals representing the passion-flower and lily, and angels bearing scrolls. The roof of the nave is of Memel wood, stained and varnished. It is supported by trusses standing on corbels, the family arms and other heraldry being carved upon it. The roof of the aisle is of a richer character, with braces and wall-posts springing from moulded corbels. The chancel roof (as is the case in the Lady Chapel) is moulded and formed into panels and closely boarded. The floor and altar-space are paved with Minton's encaustic tiles. The altar was the gift of Mr. Morley, the steward of the Burton estate, the cost being 500*l.* In the recesses the sculptures represent the adoration of the Lamb, St. Anthony, and St. George. It is built of Caen stone, and was the work of Messrs. Farmer & Co., of London. The seats in the nave and aisles are open, and are made of deal stained and varnished. From the chancel and aisle are arched openings leading into the Lady Chapel, which is fitted up with altar, &c., and is lighted by a three and two-light tracery window, and finished with foliated cross on gable. Under the chancel is the family vault of the Biddulphs, and above the chancel arch rises the bell-turret, containing two bells, and surmounted by a finial of brass. There is also a finial at the apex of the apse roof of chancel. The roof of the whole edifice is covered with brown tiles, and the ridges (which are from a new design) are of colour which blends with the other. The east window is composed of five lights, with a tracery head, under which are two moulded quatrefoil windows, and above a carved stone cross may be seen. The nave has three pointed and deeply moulded windows on the south side, and the aisle has two two-light on the north side, and a two-light window in the eastern end. The chancel is lighted by one double and three single windows with tracery heads, and all the corbels spring from carved bosses. The whole of the glazing is done with Hartley's thick rolled glass, with coloured borders and panels, and devices. Hayden's patent apparatus is used to warm the building, the furnace being under the sacristy. The walls of the edifice are faced with stone obtained from a quarry on the estate, and laid in random courses. The architect was Mr. Gilbert R. Blount, of London; and the builder Mr. John Ellis, of Chichester.

SCHOOL-BUILDING NEWS.

Newbury.—A new infant school has been erected, in connexion with the Roman Catholic Church of St. Joseph, London-road, at the cost of the Rev. F. E. Riley. The schoolroom, which is 35ft. by 17 ft. 6 in., has an open timbered roof of stained deal, plastered between the rafters. The walls are built of local red and grey bricks. The roof is slated, and has a red ridge cresting. The whole of the works have been carried out by Mr. S. Elliott, builder, from the plans and under the superintendence of Mr. J. H. Money, architect.

STAINED GLASS.

St. Peter's, Newcastle.—A memorial window of three lights has been erected in the north aisle of St. Peter's Church, Newcastle-on-Tyne, in memory of the late John Unthank and his wife. The subjects are—"The Agony in the Garden;" "Christ and Mary in the Garden;" and "The Three Marys at the Tomb." In the lower part types of the Great Sacrifice are introduced; viz., "Moses Lifting up the Brazen Serpent;" "Slaying the Paschal Lamb;" and "Sacrifice of Isaac." The tracery is filled with archangels. The window is of the Decorated period, and the groups are surmounted by foliated canopies. It was designed and executed by Mr. Baguley, of Newcastle. There are sixteen windows of stained glass in this church.

St. John's, Wednesbury.—A painted window, to the memory of the late Mr. Ambrose Lees, has just been placed in this church by Mr. Thomas Bill, the people's warden. The window is similar to the others in the south aisle, is in two compartments, and intended to form a companion window to the one given by Mr. R. Williams. The subject of the new window is the declaration of the Angel to the three women at the sepulchre, telling that Christ was not there, but had risen. The artists were Messrs. Ward & Hughes, of London.

Banbury Church. — This church has been enriched by the addition of another stained-glass window, which has been placed there by the Vicar, the Rev. H. Back, to the memory of his father. In the upper portion is the ceiling of St. Peter, encircled with the text, "Follow me and I will make you Fishers of Men." The centre compartment is Christ's Sermon on the Mount, with the text, "He opened his mouth and taught them." In the lower one is Christ healing the sick of the palsy,—"He said unto the sick of the palsy, Son, thy sins be forgiven thee." At the bottom, in the left-hand corner, is the crest and coat of arms of the deceased gentleman; and in the right is an ornamental circle with the words, "Via Trita, Via Tuta," centred with the monogram, "H.B." It has a border, with a groundwork of orange trees in full bearing. The window is from the firm of Heaton, Butler, & Bayne, of London, the same firm who did the decorations of the church and the stained-glass windows already erected.

St. Augustine's, Birmingham.—Five windows have just been completed by Messrs. Hardman & Powell for this church, at the cost of a few members of the congregation. Hitherto St. Augustine's had only one stained window, erected by the firm already named, in the centre of the apse. By the additions just made the number of pictorial windows is raised to six, and the chancel lighting completed. The series which may be described as illustrating the history of our Lord, commences on the north side of the edifice, with the incident of the Agony in the Garden. In the dexter or right-hand light our Lord is represented kneeling in prayer, whilst below sleeps St. Peter, his hand on his sword, as if engaged even in dreams in defending his Divine Master. In the companion light appears the figure of the Ministering Angel, presenting the figurative cup alluded to in the prayer of our Lord. St. John and St. James are

seen peacefully sleeping below. In the second window is pictured the Procession of the Cross. In the adjoining light the three Marys and St. John are seen mournfully following the procession, whilst a number of Jews issue from the city gate in the background. The third window, illustrating the subject of the Crucifixion, is the one previously erected in the centre of the apse. The fourth window represents the sepulchre in which our Lord's body is entombed. Window number five depicts the Resurrection. In the dexter light our Lord is shown, rising in glory from the tomb, bearing aloft the cross and banner of Victory. In the adjoining division, beneath and beside the tomb in the companion light, the guards recoil in terror and amazement from the prodigy, whilst two angelic witnesses descend from above. The Ascension is the subject of the sixth and last window. In the tracery, over the third and fifth windows of the series, are inserted the symbols of the Lamb and the Pelican, typical of our Lord and His Passion. The glass employed is from the works chiefly of Messrs. Chance Brothers & Co. The designs for the whole were by Mr. John Powell, of the firm of Hardman & Powell. In addition to the works described, Messrs. Hardman are engaged upon the manufacture of a brass altar railing, which is being presented to the church by Mr. Joseph Gillott. It is understood that the congregation have provided for the completion of the chancel in all its details.

FROM SCOTLAND.

Peterhead.—A statue of Marshal Keith, who was a native of Peterhead, and became an exile along with his elder brother, Earl Marischal, in 1715, has been presented to the town by the King of Prussia, and was recently inaugurated. Keith was a Marshal in the Prussian army, and was killed in 1758 at the battle of Hochkirchen. The statue is a duplicate (in bronze, it would seem) of the marble monument erected by Frederick the Great. The pedestal is of granite, and was provided by the inhabitants of Peterhead. The statue is 7 ft. in height, and the pedestal 8 ft. The figure is in the attire of a Prussian Field-Marshal of 1758, and holds a marshal's baton in the right hand.——The foundation-stone of a new Court-house, in course of erection at Peterhead, has been formally laid with full Masonic honours, and in presence of a large concourse of spectators.

Edinburgh.—In the Civil Service estimates for the year ending 31st March, 1870, there is included a sum of 400*l.* for renewing the tracery and mullions of the four windows on the west side of the Parliament House. At present the windows in question are partially blocked up by buildings, but it is intended that these obstructions shall be removed. The present mullions and tracery are to be taken down, and the windows will be remodelled, so as to harmonise architecturally with the great south window put in last year. They will afford a considerable increase of light to the interior. It is hoped that ere long appropriate designs in stained glass will be introduced. The designs for the alterations now decided on are being prepared by Mr. Mathieson, of her Majesty's Board of Works, who designed the south window.——A granite fountain has just been erected at Boroughmuirhead, the north-east entrance of Morningside. It is arranged in the pillar form, and hewn from Aberdeen granite. It comprises, besides drinking apparatus for pedestrians, a water-trough for the use of cattle, as well as a smaller one for dogs, &c. The design also includes an ornamental lamp on the top of the pillar. The fountain is the gift of Mrs. Nicol, of Huntly Lodge, Morningside.

Leith.—The Albert Dock at Leith has been opened. The new dock owes its origin to the rapid extension of the trade of Leith, more particularly within the last ten or twelve years. As the dock now stands completed, after five years of strenuous exertion, its leading features are briefly as follow:—The whole area reclaimed from the sea measures about 36 acres, the enclosing embankment being 3,480 ft. in length. The area of water in the dock proper extends to 10¾ acres; the entrance lock, at its western end, is 60 ft. broad by 350 ft. long; and the outer basin leading to the lock has an area of 2½ acres. On the lock sill there is at high water of spring tides a depth of 26 ft. 5 in. In the dock the depth is 28 ft. 5 in.; and in the outer basin 27 ft. 5 in. The length of the dock is 1,100 ft., and its breadth 450 ft.; the extent of quayage, 3,049 lineal ft., and the breadth of the quays, where narrowest, 200 ft. Of the whole 36 acres enclosed, the dock, lock, and outer basin together occupy 13, leaving 23 acres for wharfage, with a frontage of 1,800 ft. towards the town. At the north-west corner of the dock is provided a timber slip 80 ft. wide, with hydraulic power for unloading vessels. The lock gates are constructed of yellow pine and greenheart timber, bound together with iron bolts and straps. Each gate weighs 170 tons. By the use of the lock vessels will be enabled to leave the dock without waiting for high water. Keeping in view the construction at no distant date of the second basin designed by the engineers, provision has been made for the necessary entrance in the eastern wall of the dock just completed. The opening has been filled up with masonry. In the south-west corner similar provision has been made for establishing a connexion between the new basin and the Prince of Wales Graving Dock.

Prestonpans.—The Rev. Mr. Struthers, Prestonpans, has found a large and valuable assortment of old Scottish coins that have lain buried beneath the earth for the last three centuries. They were found a little to the east of Bankton House (Colonel Gardiner's old mansion), and are coins of the Stuarts—among others, a gold noble of the reign of Mary. Another discovery of a somewhat interesting character has just been made at Haddington, in the same neighbourhood. In the course of certain alterations made in the vicinity of the Mansion House, the workmen uncovered the foundations of what are conjectured to be the old walls of the nunnery that formerly stood here. They also came on an old well. An iron key, of a very old pattern, was the only thing found in the well.

Jamestown, Dumbartonshire.—A new Established church has been opened here. It is in the Early English style, and is from the designs of Messrs. Clark & Bell, of Glasgow. It is divided into nave and aisles, and there are three galleries, one on each side and one at the back. The interior dimensions are 60 ft. by 48 ft., and there are 800 sittings. The cost of the building is about 3,000*l.*, which has been nearly paid by subscriptions. The spire is 130 ft. high. The large west window is divided by mullions, and has elaborate tracery. The other windows are simple lancets, with the exception of a wheel window, which rises over the pulpit, and this last, together with a lancet on each side, is filled with stained glass, while all the other windows have rough cathedral glass in quarries, with coloured borderings. The whole has been executed by Messrs. Ballantine & Son, of Edinburgh.

PATENTS CONNECTED WITH BUILDING.

Buildings.—*G. Woodhouse & J. G. McMinnies.* Dated July 30th, 1868.—This invention refers, first, to the construction of buildings in which arches are required. For this purpose girders stretching from bay to bay, or other such division or compartment, are employed, and from these girders arches are sprung. Another part consists in forming the arches of tiles, brick, or similar moulded article, manufactured to the required shape and dimensions, in one piece or in two pieces, with the addition, if desired, of a central portion or key. Another part consists in the use of cast-iron beams and wrought-iron girders. The beams extend across the building, and are supported by the walls with intervening pillars. Upon these beams, and below their top surface, are formed steps or brackets, for the reception of the ends of the girders, which are then secured to the beams by angle-irons.

Brick Making.—*C. G. Johnson.* Dated August 4th, 1868.—A pug-mill is employed in combination with boxes or moulds, set in a circular or rectangular table, revolving or sliding reciprocatingly beneath an aperture in the pug-mill, in such manner that the boxes or moulds are, by the movement of the table, brought in succession opposite the orifice of the pug-mill, and are from it filled with clay, concrete, coal-dust, or other substance to be moulded into a block. When the moulds have been moved past the orifice of the pug-mill, the materials in the moulds are subjected to pressure by a piston which forms the bottom of the mould being forced upwards by its lower end coming against an incline or cam surface, whilst the top of the mould is at this time covered over with a lid or plate. The bricks or blocks are subsequently discharged from the moulds by cams or levers, and are removed, it may be, either by hand or by appliances to push them off the table on to a creeper.

Pumps.—*E. Edwards.* Dated August 6th, 1868.—This invention consists in making pumps with flexible rings instead of pistons or plungers, and flexible discs or plates for valves. For ordinary lift pumps a tube is formed, the upper part of which is expanded into a cup shape, and has a flange at the top. Upon this tube another cup, having a corresponding flange, is fastened. In the upper part of the lower tube, and in a recess just below the cup, a horizontal plate, perforated with holes, is placed, which forms the seat of a flexible valve; a bar is fitted, having a perforation through it of sufficient length and depth to allow a disc of flexible material to be passed through it, which disc, being held down by the bar, but allowed to bend up on each side of it, forms a watertight valve opening upwards.

Building Concrete Walls.—*J. Tall.* Dated 21st August, 1868.—The object of this invention is to dispense with angle or corner pieces, and also with the upright parting pieces, to which the long panels of the apparatus are attached, and also to simplify the fastenings, whereby the several parts of the apparatus are connected together, and further to construct the panels in such a manner that they may be lengthened or shortened as may be required to suit circumstances. This is accomplished by fixing the panels by means of bolts passing through tubes; the corners are composed of plates fastened to the panels in a similar manner.

Sashes.—*J. Sawyer.* Dated 20th August, 1868. Window sashes are constructed with rebated joints at the part where two sashes meet together when shut for the purposes of better excluding the air, rain, and wind. The window sashes have metal plates with teeth or cogs on one side thereof, or are formed with indentations or slots, forming racks. These racks are of the same length as the height of the sashes, and are let into grooves, or rebated in the sides or edges thereof flush therewith, or they may form projections thereout for the purpose of hanging or suspending the window sashes.

Artificial Fuel.—*W. H. Crispin.* Dated 5th September, 1868.—The fuel is formed by taking about 1 ton of coal in a pulverized state, and adding thereto about 6 or 7 per cent. by weight of pitch, the same having been previously dissolved in about an equal weight of creosote or "heavy" oil resulting from the distillation of coal-tar, or in any hydrocarbon fluid or fluids possessing similar solvent powers. The coal and pitch having been thus combined, about 3 per cent. by weight of lime, and 3 per cent. of chloride of sodium (common salt) are added.

Preserving Submerged Iron Structures.—*H. J. Turnbull.* Dated 14th September, 1868.—In order to prevent the oxidation of the iron it is covered with a composition, consisting of gutta-percha and resin dissolved in combination with pine varnish. The surface of the metal is first cleaned and prepared, and the composition is mixed and applied in the following manner. The surface of the iron is, first, to be made clean by the application of muriatic or other acid brought to a proper consistency by the addition of ivory black and pine varnish. This mixture is then applied with a brush, and after being left upon the iron for a few hours, it must be scraped or washed off with water in which a little soda is dissolved. When the surface of the metal thus prepared has become dry, the anti-oxidising composition is applied. The anti-fouling composition, for preventing the adhesion of barnacles and marine vegetation to the surface of iron or other submerged material, is made by dissolving four ounces of phosphorus in 16 ounces of bisulphuret of carbon, and 2 ounces of absolute vegetable naphtha spirit. Then 2 pounds of shellac and 2 ounces of gum benzoin are dissolved in absolute vegetable naphtha spirit, bisulphuret of carbon, or other solvent, to the consistency of thick paint, and the solution of phosphorus is added thereto.

Manufacture of Gasfittings.—*E. Sarjeant.* Dated September 15th, 1868.—This consists in connecting or joining together the parts of the gasfittings by the process of casting in metal or chill moulds.

Fastenings. — *F. F. Greenwood.* Dated September 16th, 1868.—The patentee combines the frame of the buckles with the frame or box of a lock, so that the whole forms one piece. Beyond, and raised above that part of the buckle which receives the free end of the tongue when closed down, he forms a bow-shaped bar or loop; or he makes a hole in that part of the buckle to

receive the tongue at pleasure, and he hinges the base of the tongue upon the bolt of the lock. When the bolt tongue is discharged from the lock he thrusts the free end under the bow-shaped bar. The protrusion and withdrawal of the bolt tongue may be accomplished either by the use of a separate key or by means of the mechanism of the lock buckle itself.

Fire-grates.—*G. B. Sharpe.* Dated September 16th, 1868.—The grate or fire-holder is made of bars of iron bent into a semicircular or other form, and the ends of these bars are riveted on to two upright pieces of iron. The bottom of the grate consists of bars riveted on to the lowest semicircular side bar. The ends of the top and bottom semicircular bar project beyond the upright pieces, and are bent down so as to form hooks, which fit into iron eyes secured by and fixed in or upon the fixed back of the grate.

Combustion of Liquid Fuel.—*J. H. Johnson.* A communication, dated 15th September, 1868.—This invention consists in burning liquid fuel directly, and without any admixture of steam or water, upon a peculiar grate disposed either vertically at an angle or horizontally. When horizontally disposed, the liquid fuel is impelled or caused to flow over the surface of the grate by pressure. It flows in a number of small streams along the face of the several grate bars, which are grooved or channelled longitudinally for that purpose, and having connected to them at their upper ends small liquid fuel supply pipes. These several supply pipes are fed from a regulator above, which receives the liquid through pipes, and a stop-cock in connexion with a tank or reservoir situate at a higher level. The air for supporting combustion enters between the grate bars as in the ordinary furnace grates. The furnace chamber may either be composed of fire-clay or surrounded with water spaces, and fire-brick deflecting arches or bridges may be disposed therein as found requisite.

Hot-water Apparatus.—*F. Dyer.* Dated 19th September, 1868.—This invention consists, first, in the use of the tubular fire-back made of malleable iron or other metal, cast in one piece from tubes crossed, or cast, or wrought in any other way, or constructed of pipes or tubes of any form or shape, and of any metal. Secondly, in the manner of connecting the tubular fire-brick with the hot-water cylinder. Thirdly, in the application and use of a return pipe with ball-valve inserted to prevent the upward flow of water in the return pipe. Fourthly, in the method or mode of connexions, by which all parts of a dwelling-house or other building can be supplied with hot water by the use of a hot-water cylinder, reservoir, or tank placed near the kitchen fire and in connexion with the tubular fire-back.

Door Handle.—*W. R. Lake.* A communication, dated 9th November, 1868.—This consists chiefly in the employment of a spring setting into a ratchet cut on the knob spindle. This spring is fitted in a chamber formed in the spindle aperture of the knob or handle, and ratchet teeth are formed on one side of the spindle at one or both ends, a longitudinal aperture being formed or left at that part of the spindle in which the said teeth are cut, in order to permit of the spring being forced out of the teeth when the handle or knob is required to be placed nearer the end or withdrawn from the spindle. A small hole is formed in the shoulder of the knob or handle, and near the working or loose end of the spring, to permit of the insertion of a bradawl or other simple instrument that will pass through the aperture or slot, and press against the said loose end of the spring, in order to force the latter from the teeth, and thereby release the said knob.

Distributing Sewage Water.—*O. G. Abbott.* Dated 10th November, 1868.—The centre portion of the apparatus consists of two lightly-constructed wheels capable of revolving upon a perforated tube, which constitutes the axle. The ends of the tube project from the wheels, and are provided with flanges, for the purpose of conducting additional perforated tubes thereto, and by means of which the range of the apparatus can be extended as desired, such additional perforated tubes being supported at their extremities by wheels, each of which revolves upon a short hollow axle, the same being loose and flanged on each side of the nave. The axle of the central portion of the apparatus is furnished with projecting bars, from which strengthening ropes of wire or other suitable material may be extended to the extremities of the additional tubes, for the purpose of keeping them in position, such ropes being tightened by means of any suitable contrivance.

Wall Hangings.—*C. E. Brooman.* A Communication, dated November 12th, 1868.—This consists in producing or effecting the painting or colouring upon metallic foil, by preference tin-foil. The inventor takes thin tinfoil, which possesses great flexibility; he spreads it upon a hard, smooth surface, such as glass, taking care to damp the glass, in order to facilitate the spreading and retention of the foil. The foil thus spread constitutes a very smooth surface, on which he paints or colours in oil, either plain or ornamental, as on walls or wainscots. The inventor now allows the colour to dry, and varnishes it. This portable painting, when removed from the glass with its lining of tin, is ready to be applied in a house or otherwise.

Books Received.

Picturesque Examples of Old English Churches and Cottages from Sketches in Sussex and adjoining Counties. By William Young, Architect. S. Birbeck, Birmingham. 1869.

Whether the brilliant cover of this book, with the title "Picturesque Architecture" upon it, induced unreasonable expectations, or however it may be, we are forced to confess to a certain amount of disappointment with reference to it. It is, in fact, a collection of pen-and-ink sketches, thirty in all, of a number of buildings for the most part thoroughly well known, and more precisely delineated elsewhere. Several of the sketches are clever and pleasing; but what Mr. Young can find to admire in the frightful Thatched Cottage, Isle of Wight (pl. 21), or in the lumbering West End of Radipole Church, Dorset (12), we are at a loss to conceive. We speak thus candidly with less hesitation as the author informs us in his preface "that the first edition was nearly all sold when the work was no more than half done."

Every proper endeavour has been made to render the names appended to the views illegible.

Dictionary of Scientific Terms. By P. Austin Nuttall, LL.D. Strahan & Co., 1869.

At a time when scientific and technical education is so much needed, the issue of a dictionary of terms in use in the practical sciences is timely, and cannot but be useful; more especially a good one as this seems to be; although, no doubt, within the limits of it there are not a few omissions. Nevertheless, great pains seem to have been taken to render it as complete as possible, considering these limits. The work is preceded by a useful introduction to the classification and study of the sciences.

Report of the Metropolitan Board of Works, 1868-9. Waterlow & Sons, Printers.

This last annual report of the Metropolitan Board is not so voluminous as some previous reports have been.

Under the head of Utilisation of the Sewage, the Board state their regret that the Metropolis Sewage and Essex Reclamation Company, who had formed a portion of the culvert to convey the sewage to Maplin on the Essex coast, "have not been able to continue the works;" and the Board gives no hope of any immediate resumption of these works, or of anything to supersede them; except that under the head of South Side of the Thames they say that they trust that the "postponement of the question (as to the utilisation of the sewage on both sides of the river) will be only temporary, and that a revival of enterprise and the re-establishment of more favourable financial conditions will enable the subject to be successfully dealt with at some future period."

It is said, as to the Thames Embankments:—

"In reference to the Thames Embankment (North), the Board have before them the question of forming a subway under the Embankment roadway to the Westminster Steamboat Pier, in continuation of the one now in course of construction under Bridge-street, for access from the Houses of Parliament to the Metropolitan District Railway Station and the intended footway on the land side of the Embankment. The formation of the roadway still remains in abeyance, pending the completion of the works of the Metropolitan District Railway, which would materially interfere with and obstruct the traffic of the thoroughfare; but arrangements have been made for the construction, when the proper time arrives, of the entire roadway from Westminster to Blackfriars, the work being included in the contract for that portion of the Embankment east of the Temple Gardens, now being executed."

With regard to the Southern Embankment, the report says:—

"At the present time the whole of the river wall is complete, and the dam, with the exception of about 150 ft., has been removed. The Westminster Landing Stairs, the dock entrances, and other incidental works, are either already finished or fast approaching completion. A footway, 20 ft. wide, extending from Westminster Bridge to Lambeth Church, has been open to the public since the 1st of May, 1868. About 8½ acres of the ground of the Embankment westward from Westminster Bridge has been purchased by the governors of St. Thomas's Hospital for the purposes of the new hospital, the construction of which is now being proceeded with. The amount of the contract for the Southern Embankment is 309,000*l.*, and the value of the works executed up to the present time is 238,000*l.*"

As regards the ventilation of sewers, the report states that the Board have hitherto not been able to adopt any mode of dealing with it sufficiently sure and practicable to enable them to apply it generally throughout the metropolis. The subject is now under the consideration of a committee of the Board.

VARIORUM.

"Van Nostrand's Eclectic Engineering Magazine. Selected from home and foreign Engineering Serials. New York: D. Van Nostrand, Murray-street." Several monthly numbers of this magazine, including No. 8 (vol. 1) for August, 1869, are before us. Being selected from standard sources, including English ones, such as the *Engineer*, the *Builder*, *Scientific Opinion*, and various others, the work, of course contains much useful matter, but we have little regard for "eclectic" publications, which, without either leave or payment, appropriate matter, right and left, for which respectable journals have incurred considerable outlay.——"The Fresh and Salt Water Aquarium," by the Rev. J. G. Wood. This little volume, by the well-known author of "Common Objects of the Country and Seashore," is full of interesting and curious matter, and forms a competent guide to those who wish to form aquariums for fish and shell-fish, sea and fresh water reptiles, and insects.

Miscellanea.

Report on Health of St. Marylebone.—The annual report of Dr. Whitmore, the medical officer of health for the parish of St. Marylebone, has been issued in a printed form. On the subject of sanitary work, the report says:—"2,413 houses and 131 mews and stables were inspected, 9,298 ft. of new pipe-drain were laid down to supply the place of old and defective brick drains, 616 houses were wholly or partially cleansed, and 1,695 other houses underwent sanitary improvement in various ways; 1,841 yards were cleansed, repaved, and limewhited, and a water supply was laid on to 589 closets. By comparing these with the returns of previous years, it will be seen that the sanitary work of last year greatly exceeded that of every other: this is satisfactory as showing commendable activity on the part of the sanitary inspectors, and eminently so if considered in connexion with the reduced death-rate, to which this work, it may fairly be assumed, has materially contributed." But a very large portion of such sanitary work is but of very transient benefit, owing to the filthy and destructive habits of many of the destitute poor; with them there is an ever-recurring necessity for such work, and nothing short of the most unremitting care and vigilance will suffice to maintain, even at its present standard, the health of our local poor.

Proposed Abattoir for Bath.—The local officer of health, Mr. Barter, has made a report to the City Act Commitee, in which he protests in the strongest terms against any plan of rebuilding the old slaughter-houses in Boatstall and Lott Lanes. He further recommends the local authorities to avail themselves of the opportunity which now offers for constructing an abattoir for the general use of the city, and thus removing from the centre of the town and the midst of residences, buildings which cannot fail to be an offence to the immediate neighbourhood in which they stand, as well as a detriment to public health.

Burns's Pew.—The pew formerly in St. Michael's Church, Dumfries, used by Burns, and bearing in one part the initials R. B., cut with a knife by his own hand, was bought in at a sale recently, the reserved price 5*l.* not being reached in the bidding! What had the auctioneer been about?

Inside an Abyssinian Church.—Dr. Blanc, in an interesting series of papers on Abyssinia in the *British Medical Journal*, writes:—Except in the province of Tigré, all the churches in Abyssinia are circular, the walls generally of mud and stone, the roof conical, and thickly covered with straw. The church proper consists of three concentric circles;—the first, a kind of verandah, wherein the congregation assembled; the second, the church itself, where the priests perform their ceremonies; the third, or innermost circle, the "Holy of Holies," containing the sacred vase and the "Tabot," a small square piece of wood, having on one side a cross, on the other three stars, symbols of the Trinity, and on which are carved the name of the church, and that of the bishop by whom it was consecrated. The verandah is, for the stranger, the most interesting portion of the edifice. In some, like "Medani Alum" (Saviour of the World), the church we visited that day, the paintings that adorn the walls, all considering, are not badly made. St. George and the Dragon in the church of Medani Alum held a prominent and conspicuous place; next came the Twelve Apostles and the Trinity, God being represented in the form of a benevolent-looking old gentleman. Several representations of our Lord's sufferings graced the walls.

New Chapel of St. John, Ripon.—On Tuesday, the 10th instant, the above new hospital chapel was consecrated by the Right Rev. the Lord Bishop of Ripon. The chapel is rectangular in form, with apsidal chancel, the total length being 72 ft., width across nave 24 ft. 6 in., the height to ridge 33 ft. The entrance porch is on the south side, and is of open timber-work in oak, with traceried sides and barge boards. The vestry is in the north-east corner, and communicates direct with the chancel, which is paved with encaustic tiles. The altar-rail and pulpit are of oak, and the seating throughout is of deal, stained and varnished. The ceiling is formed in panels of moulded timber filled in with plaster, and the roof is covered with green rag slates. The west gable is surmounted by a wrought stone bell-cot. The chapel is intended to accommodate 250 people, including children, and is carried out in the Late Pointed style, at a cost of about 1,300*l*. The architect is Mr. W. H. Crossland, and the contractors are—Messrs. John Chambers & Son, of Bishop Monkton, for mason, slater, and plasterer's works; George Grange, Pateley Bridge, joiner; Christopher Daniel, of Ripon, plumber; and John Burton & Son, Ripon, painters. The heating apparatus, which is fixed in a cellar under the vestry, has been fitted up by Mr. R. Nicholson, of Ripon. The chapel is lighted with gas, the fittings for which have been supplied by Messrs. Hardman & Co., of Birmingham, who also provided the lectern and pulpit-desk.

Omnibus Traffic.—There are one or two facts of interest in the report of the London General Omnibus Company. The number of passengers carried during the half-year was 20,157,926 against 20,313,821 the year before; the average number of omnibuses working on week-days was 590 against 594, and on Sundays 460 against 461 in the same half of 1868. The company have been giving their horses maize instead of oats, and have saved by so doing about 14,000*l*. in the half-year! The gross receipts of the company during the half-year ending 30th June, 1869, were 270,925*l*. 16*s*. 8*d*., showing a comparative decrease of 13,854*l*. 17*s*. 10*d*.—— The scale on which omnibus traffic is carried on in Paris may be judged from the fact that during the year 1868 the number of persons carried in these vehicles amounted to 120,000,000, or nearly 65 times the entire population of Paris; while during the same period the number of passengers conveyed by the French railways was only 115,000,000. The average fare was four sous and a half (six sous in the interior and three on the impériale). The gross receipts must have amounted to about 27,000,000*f*.

Public Drinking Fountains for Swansea. At the last meeting of the trustees of the Swansea Harbour, the Mayor, Mr. C. T. Wilson, asked permission to be allowed to erect two public drinking-fountains, one at each end of the South Dock, on the land of the trust. Permission was unanimously granted. At the meeting of the Corporation, also, the Mayor obtained the permission of the Council to erect a third fountain near the public weighbridge on the Quay. The necessary accommodation for animals will be provided for.

Erection of another Race-stand at Doncaster.—The stand for the special accommodation of county families is approaching completion. It is situate at the west end of the enclosure, just beyond the judge's chair. It is built of white pressed bricks, and is carried out in a style uniform with that of the other stands, with balustrades and pillars in front. The basement comprises weighing-room, an office for the clerk of the course, and reporter's room. The weighing-room occupies the principal portion of the lower floor, being 35 ft. 6 in. long and 17 ft. 3 in. wide. The second floor is occupied by the saloon, 61 ft. 4 in. in length and 17 ft. 6 in. wide. It contains thirteen windows, and communicating with it are two rooms for ladies. On the ground floor is a room for gentlemen. The roof of the stand will be divided into two parts, one portion to be appropriated to the lessees for whom the stand is erected, and the other to the reporters, trainers, jockeys, &c. The work has been let to Mr. Thomas Wood.

Free Libraries.—The free library question was thoroughly discussed last year in Leeds, and at a public meeting the necessary proportion of ratepayers' votes was obtained in favour of the establishment of such an institution. The scheme, however, met with considerable opposition in and out of the town council. A special meeting of the council was recently held to reconsider the subject, and it was resolved, after a long discussion, to carry into effect the resolution passed at the public meeting last year.—— At Wokingham, a preliminary meeting has been held in the town-hall, presided over by the alderman, to consider the subject of establishing a free library, in consequence of a liberal offer by the Hon. Auberon Herbert in aid of the object. A discussion ensued, in which all heartily joined in the opinion that an effort ought to be made to enable the town to participate in the benefits which the foundation of a free library on a large scale was likely to confer. Windsor will also take advantage of Mr. Herbert's offer.

Philomatic Society of Paris.—At the sitting of the society on the 24th ult., M. Caligny made a communication on the subject of the means of utilising the force now expended uselessly by the waves of the sea. This subject has recently commanded a good deal of attention in America, where already an apparatus has been described and a patent, we believe, taken out for this purpose. M. Caligny stated that the question was raised as early as 1851 by the Philomathic Society. [A proposal to use the tides at Westminster as a motive power was published in an old volume of the *Builder*.] The machine described now seems to consist of a series of curved tubes which are so placed that the shock of the wave passes along their horizontal portion and sets in motion a column of liquid, which in its turn moves a series of pistons, and so transmits in any fashion that may be desired the force of the wave.—*Scientific Opinion*.

Another Railway Bridge over the Rhine. The great railway bridge which is to cross the Rhine, near the village of Hamm, a little above Dusseldorf, will probably be completed before the end of November. The structure consists of four arches, the upper part of which is of iron. The ironwork of each will weigh 14,000 cwt. The bridge is united to the main line on the left bank by a viaduct consisting of fifteen stone arches, but this does not immediately join the bridge, being separated from it by a revolving drawbridge, so that the line can be rendered impassable at any moment. The first arch of the great bridge is completed.

Overcrowding in Barracks.—It surely cannot be true, as reported, that experiments are being conducted in the barracks at Gosport and Portsmouth to obtain data as to the possibility of increasing the number of inmates in each room without severe injury to health. Overcrowding in our barracks has long been a prolific source of disease, and has been proved to be one of the most powerful agents in the production of consumptive maladies. Every step taken ought to be in the opposite direction.

Official Building on the Thames Embankment.—We hear a report, the correctness of which we cannot guarantee, says the *Pall-mall Gazette*, that the sanction of the Government has been given to the erection, somewhere on the Thames Embankment, of a building which shall accommodate both the War Office and the Horse Guards.

Trade-Union Congress.—The second annual congress of trade societies of the United Kingdom has been held in the Odd Fellows' Hall at Birmingham. The list of subjects covered pretty nearly the whole ground of trade legislation. There were on the list 12 subjects, and 17 papers; and the number of societies represented was 32. Applications by Mr. Dixon, M.P., for the secretary of the National Education League, and by Mr. G. J. Holyoake, to read papers, the latter on co-operation, and the former on the League, were acceded to. The congress passed a resolution, by a large majority, in favour of courts of conciliation and arbitration.

Inverness Cathedral.—The cathedral of St. Andrew, Inverness, of which the first stone was laid in 1866 by the late Archbishop of Canterbury, is to be opened on the 1st of September. This new edifice is situated on the west bank of the River Ness, and nearly opposite the Castle. It is in the Decorated style, and has been built from the designs of Mr. A. Ross, architect, at Inverness, and consists of nave, north and south aisles, transepts, and apsidal east end, with an octagonal chapter-house on the north-east side. It is flanked by two towers at the west end, each 100 ft. high, and an ornamental iron *flèche* springs from the intersection of nave and transepts to a height of 110 ft. from the ground. The building with all its internal fittings and decorations, will cost something under 20,000*l*., it is stated. Various gifts have already been presented, such as eleven stained glass windows (by Hardman, of Birmingham), a pulpit carved in Caen stone, and ornamented with marble shafts, by native artists; an altar and reredos in Caen stone, marble, and alabaster, executed by Earp.

Preston House of Correction.—A range of 150 cells for male prisoners and a new hospital were recently erected at the Preston House of Correction, and a range of 72 other cells for females has been just completed from plans of Mr. Hughes, of Preston, architect; the contractor being Mr. Bickerstaff, of Preston, and the clerk of the works Mr. Chappell. The contract for the last-mentioned cells has been completed for a sum less than the amount of the accepted tender, some alteration in the work having been made during its progress which has led to larger deductions than extras. The original contract was 6,017*l*., and the bills paid amount to 6,005*l*.

The Velocipede Movement.—A short time ago an intimation appeared in *Punch* that a velocipede capable of carrying a man and his family would be useful; and a man employed at Staveley Works, named William Minkley, has acted upon the hint and has constructed for himself, during his leisure hours, a family velocipede. The machine is said to be capable of carrying himself, his wife, and family—four of them—and is very strongly built.—— A new velocipede is being patented in Paris, which is to throw all others into the shade. It has five wheels, and the motive power is communicated to it by the mere weight of the riders.

Metropolitan Railways' Artillery.—"Nervine" writes,—Kindly urge the directors of these railways to be good enough to affix something like the following notice at the several stations:—"As the public in general, and females in particular, have nerves, the porters and guards are desired not to slam, bang, or crash the doors to, as they have got into the habit of doing, to the great annoyance of passengers, but to close them as gently as time will permit."

Evil Writings at Railway Stations.—The "Retreats" at railway stations are in many cases disfigured with indecent writings,—more shame to the contemptible perpetrators of the offence. A correspondent suggests, and wisely, that the porters should be instructed to use the white-wash brush once or twice a week. If an offender were detected, and the porter poured the contents of the pail over him, the whitened blackguard would get no pity from us.

South Shields Townhall Competition. The committee appointed to select a design from those sent in for the proposed new town-hall, South Shields, have held a meeting in the Mechanics' Institute, South Shields, where twenty-seven sets of competitive plans were exhibited. A few of the designs, and only a few, deserve serious attention.

The British Association for Science will hold its next meeting in Liverpool. Professor Huxley will be the president.

A Machine that Reaps and Thrashes.—A private letter from California gives a description of the reaping-machine in use there, known as a harvester. It is pushed by six horses, and cuts, heads, thrashes, and delivers into bags at one operation, the grain being sufficiently dry to be thus dealt with. The straw is afterwards set on fire.

South Kensington Improvements.—A correspondent says the old summer-house was removed to the Bayswater side, and a portion of the dead wall taken down and replaced with iron railing, at the expense of Mr. Cawley, the builder of Prince of Wales-terrace, Kensington, opposite whose property it stood.

Harrogate Surveyorship.—At a meeting of the Harrogate Improvement Commissioners and local Board of Health, held on Monday last, it was resolved, on application from Mr. Richardson, the surveyor, that he be allowed to practise privately in conjunction with his public appointment as town surveyor.

TENDERS.

For minister's house at Paulersbury, Northamptonshire. Mr. T. Heygate Vernon, architect:—

Shelton	£520	0	0
Shakeshaft	515	10	0
Ancell	455	10	0
Lepper	444	17	0
Wheeler (accepted)	416	5	0

Accepted for five houses and two shops at Ossett for Mr. Joshua Whitaker. Messrs. Sheard & Hanstock, architects:—

Mason's Work.

Chapel	£784	0	0

Joiner's Work.

Lockwood	250	0	0

Plumber's Work.

Snowden	61	0	0

Plasterer's Work.

Wilson & Co.	80	0	0

Slater's Work.

Thornton	65	12	3

For dwarf wall and enclosure railing to land belonging to the Clock and Watchmakers' Asylum, Colney Hatch. Mr. Henry Carpenter, architect:—

Foxley	£426	10	0
Thompson	353	0	0
Clark & Hunt	342	0	0
Turner & Co.	331	15	0
St. Pancras Iron Co. (accepted)	320	0	0

For a new house on Wandsworth-common, for Mr. James Neal, who provides bricks, lime, and sand. Mr. S. Durrant, architect:—

Easton Brothers	£1,099	0	0
Hearn & Couts	1,089	0	0
Strong	899	0	0
Heron	795	0	0
Thornton	795	0	0
Atkinson	778	0	0
Cock	745	0	0

For alterations to two houses in Essex-street, Strand. Messrs. Clarkson, architects:—

Howard	£989	0	0
Langmead & Co.	971	0	0
Axford	915	0	0
Sykes	746	0	0

For the erection of a Wesleyan chapel at the Old Delabole Slate Quarries. Mr. Patterson, architect:—

Westlake & Cann	£477	0	0
Hitchins & Paull	475	0	0

For roads and drains, Chaseville Park, Winchmore-hill, for Mr. Charles Stokes. Quantities by Mr. J. C. Timmis:—

Haynes	£1,348	0	0
Turner & Cole	1,111	15	0
Jay	1,085	0	0
Potter	1,060	0	0
Burgess	975	0	0
Crockett	960	0	0
Hubbard	935	10	0
Henley	888	0	0
Hookham	830	0	0
Cohen	820	0	0
Paice	818	0	0
Morris	816	0	0
Nicholson	810	0	0
Bloomfield	806	0	0
Keeble	775	0	0
Porter	760	0	0
Kent	750	0	0
Alldred	745	0	0
Capper	668	0	0
Carter	640	0	0

For alterations to the Parochial Schools at Sawbridgeworth, Herts. Mr. Pritchett, architect. Quantities by Mr. Shrubsole:—

Hockley	£519	0	0
Thackrah	512	0	0
Dickinson	435	0	0
Crabb & Vaughan	433	0	0
Glascock	390	0	0
Burton	380	0	0
Prior	378	0	0
Shirley & Horne	370	0	0
Bent	339	0	0

For detached villa residence, with tower, for Mr. J. Lindner, at Nightingale-lane, Balham. Mr. Rowland Plumbe, architect. Quantities supplied by Mr. C. W. Brooks:—

Wilson (accepted)	£3,127	0	0

For new Parochial Schools at St. Paul's, Anerley (first portion). Mr. Elkington, architect:—

Perry	£910	0	0
Buck	742	0	0
Langman	660	0	0
Bowyer & Sons	640	0	0
Hollidge (accepted)	635	0	0

For building warehouses in Camomile-street, for the London and County Land and Building Company, Limited. Mr. Robert Walker, architect:—

Bayes & Ramage	£10,796	0	0
Sewell & Co.	10,371	0	0
Colls & Son	10,332	0	0
Browne & Robinson	10,176	0	0
Oxford & Willier	10,074	0	0
Newman & Mann	10,072	0	0
Myers & Son	10,028	0	0
Ashby & Sons	9,966	0	0
Macey	9,497	0	0
Hill, Keddell, & Co.	9,491	0	0
Kilby (accepted)	9,167	0	0

For new church in St. Andrew's parish, Hastings, for the Misses Sayer. Messrs. E. Habershon & Brock, architects':—

Parks	£4,052	0	0
Sharpington & Hole	3,888	0	0
Wilkins & Son	3,819	0	0
Nightingale	3,653	0	0
Vidler	3,091	0	0
Perry	3,489	0	0
Hughes	3,380	0	0
Langridge	3,264	0	0
Howell	3,235	0	0

For the erection of three shops and premises in High-street, Aldershott, for Mr. Phillips, jun. Mr. Mussellwhite, architect:—

Hughes	£1,230	0	0
Stiff	1,178	0	0
Seabright	1,136	8	8
Mether	907	0	0
Wells & Batchelor (accepted)	811	0	0

For the alterations and additions to eight houses, and for erecting two new houses in the St. Mary's-terrace, Paddington (being contract No. 1), for Mr. T. Dimsdale. Mr. Albert Bridgman, architect. Quantities supplied:—

Bennett (accepted)	£1,980	0	0

For the erection of a pair of semi-detached villas in the Loughton Park, Essex, for Mr. Henry Ellis. Mr. Albert Bridgman, architect:—

Bennett	£1,999	0	0
Egan	1,996	10	0
Keepence	1,995	0	0
Knight & Sons	1,780	0	0
Pavitt (accepted)	1,734	0	0

For house, stabling, boundary wall, &c., at Waltham Cross, Herts, for Mr. J. Dormer. Mr. J. S. Gomme, architect:—

Bentley	£974	0	0
Archer	921	0	0
Brunsden	871	0	0
Dean	754	0	0

For the erection of a villa residence in the London-road, Reading, for Messrs. Sutton. Messrs. Wm. & J. T. Brown, architects. Quantities supplied:—

Wheeler Brothers	£1,996	0	0
Woodroffe	1,866	0	0
Sheppard	1,844	0	0
Strong	1,824	0	0
Matthews	1,777	0	0
Barnicoat (accepted)	1,746	0	0

For the erection of a house and shop, London-street, Reading, for Mr. Lovejoy. Messrs. Wm. & J. T. Brown, architects. Quantities supplied:—

Matthews	£1,095	0	0
Barnicoat	1,091	0	0
Sheppard	999	0	0
Clacy	998	0	0

For alterations and additions to house and shop, Broad-street, Reading, for Mr. Pooley. Messrs. Wm. & J. T. Brown, architects:—

Wheeler Brothers (accepted)	£600	0	0

For a pair of villas at Fortis-green, Finchley, for Mr. George Emden. Messrs. W. Waymouth & Son, architects.

Merritt & Ashby (accepted)	£2,058	0	0

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